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UNITED STATES PUBLIC HEALTH SERVICE

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RURAL SCHOOL SANITATION

INCLUDING PHYSICAL AND MENTAL STATUS OF SCHOOL CHILDREN IN PORTER COUNTY, INDIANA

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RURAL SCHOOL SANITATION.

INCLUDING PHYSICAL AND MENTAL STATUS OF SCHOOL CHILDREN IN PORTER COUNTY, IND.

By TALIAFERRO CLARK, GEORGE L. COLLINS, and W. L. TREADWAY.

Because of the recognized importance of school hygiene to public health and on request of the Indiana State Board of Health and the Porter County, Ind., health and school officials, a sanitary and medical survey of the rural schools of this county was made by the Public Health Service and completed on May 10, 1915.

This investigation included a sanitary survey of school locations and buildings, a study of the physical fitness of rural school children, and mental tests of these children. On the basis of the results obtained recommendations were made to the health and school authorities of Porter County. It is believed that many of these are of general applicability, and they are, therefore, included in the following report of the results obtained in this investigation.

PART I.

A SANITARY SURVEY OF RURAL SCHOOL LOCATIONS AND BUILDINGS.

GENERAL CONSIDERATIONS.

Porter County is the central of the three counties occupying the extreme northwestern corner of Indiana which are bordered by Lake Michigan on the north. It has an area of 415 square miles. Valparaiso, the county seat, is located near the center of the county in latitude 41° 28″, north, and in longitude 87° 04″, west. The population of Valparaiso in 1910 was 6,987. The schools of this city were not included in the survey.

Topographically, Porter County[1] is comprised in the prairie section of Indiana. The county is covered with a sheet of glacial drift, ranging in thickness from 90 to 141 feet. From north to south the surface of the county comprises three distinct belts: The Calumet, the Morainic, and the Kankakee Basin regions. Of these, the Morainic is the most elevated. The Calumet in the north and the Kankakee in the south are lower and more level.

The underlying rocks of this county are black Genesee shale of the Devonian age and are about 65 feet thick in the vicinity of Valparaiso. Beneath this shale is found Lower Helderburg and Niagara limestone strata in the order mentioned.

The geological formation of Porter County is interesting from a medical standpoint because the underlying rocks are of the same geological formation as has been found by one of the writers (Dr. Clark) in other regions associated with an extensive prevalence of simple thyroid enlargement. The wide prevalence of this condition observed during this survey will be discussed in greater detail in another place in this report. (See p. 92.)

Artensian waters in this county have a very high lime content.

The county is traversed by several trunk-line railways. The county roads are in good repair and of the macadam-gravel type. The schools of the county are so situated with respect to gravel roads that nearly all of them may be reached by automobile at any season of the year. The principal industry of the county is agriculture.

[1] The Geology of Lake and Porter Counties, Ind., by W. S. Blatchley.

Population.—The population of the county according to the 1910 census was 20,540, classified as follows: Males, 10,999; females, 9,541. These in turn are subdivided into the following classes: Native white persons of native parentage, 11,699; native white persons of foreign or mixed parentage, 5,880; foreign-born white persons, 2,939; negroes, 8. At the time of the census the foreign-born white persons comprised 14.5 per cent of the total population. The estimated population of the county at the completion of this survey, May 10, 1915, was 21,250.

School population.—The school population of the county, according to the annual school census completed subsequent to the termination of this survey, was as follows: Total number of unmarried persons from 6 to 21 years of age in the county entitled to free school privileges, 3,933; namely, 2,078 males, 1,857 females. Of these there were 621 individuals 14 to 16 years of age. The total school enrollment for the year was 3,103, which included one parochial school with an enrollment of 104 pupils.

School attendance.—The average daily attendance for all rural public schools was 2,264 in the elementary schools, and 248 in the high schools. The city of Valparaiso is not included in this enumeration. The total number of unmarried persons 6 to 21 years of age in the Valparaiso schools was 1,653. Of these 200 individuals were from 14 to 16 years of age. The total enrollment in the Valparaiso schools was 1,173. The average daily attendance in the Valparaiso schools, excluding one parochial school, during the year 1914–15, was 1,029. The average daily attendance was 835 in the elementary schools and 194 in the high school, exclusive of children attending the parochial school.

Sociological data.—The average number of children in a family in the county was found to be 4.8—2.44 boys and 2.36 girls. Seventy-four children reported the occurrence of tuberculosis at some time or other in the family, and 129 children reported the death of their father, 141 the death of their mother, and 11 the death of both parents.[1]

Extent of survey.—In all 75 school buildings were surveyed and medical tests were made of the children attending 76 schools, including one parochial school, in the rural districts of the county.

SCHOOL LOCATIONS.

In a number of communities, although due consideration had been given to the construction of the school building, the school site had been unwisely selected.

[1] There were 2,488 pupils in the county, while 5,998 boys and 5,785 girls were reported in all families.

Requirements.—The ideal requirements for school grounds are that they be of ample size to allow sufficient playground space for each pupil, protected from soil pollution by the establishment of sanitary privies, in a healthful location with sufficient elevation to insure good drainage, readily accessible to as large a part of the school population as possible, of ample proportions to furnish an unobstructed sky surface for illumination, and sufficiently isolated to avoid disturbing noises and other nuisances.

Elevation.—With the exception of the Morainic belt, traversing the county slightly north of its center, Porter County is largely level prairie land. However, the elevation of school sites was found to be good in 24, fair in 24, and poor in 27 instances.

Drainage.—In some locations special efforts had been made to secure subdrainage of school grounds. This was found good in 40, fair in 26, and poor in but 9 instances.

Walks.—The necessity for walks is apparent. One leading from the roadway to the school entrance is better than none at all, but others should lead to the fuel supply and to outside privies. Otherwise children are liable to refrain from attending to the calls of nature during inclement weather, and in so doing easily acquire the "constipated habit," which begets a condition of physical and mental hebetude incompatible with efficient school work. A large part of the dirt found in rural schools is brought into the classrooms on the children's feet. Where there are no walks this condition is aggravated.

Walks were observed at 30 schools in the county. Of these, 12 were entrance walks only. In the other 18 schools there were walks leading to one or both privies.

Shade.—At 17 schools the grounds are more or less shaded; in some cases sparsely, in a few others too thickly. The latter is especially true of the Washington Township High School and Flint Lake School, Center township. Too much shade promotes dampness and materially limits the daylight illumination of the classrooms.

Proximity to nuisances.—The location of 17 schools was in more or less close proximity to nuisances, as follows: Barnyards, 2; cemeteries, 3; marshy land, 1; ponds, 2; railroads, 10; trolleys, 3. The grounds of the Flint Lake School of Center Township are adjacent to a pond, barnyard, and a trolley line, a conspicuous example of subjection to nuisances.

The noise occasioned by the passage of trains over trunk-line railroads, near which so many schools in this county are located, must in time exercise an injurious effect upon teachers and pupils by exciting a condition of nervous irritability.[1]

[1] Notably is this the case in the Frye School, Boone Township, Kouts School, Pleasant Township, and at the Old Porter and Porter Schools in Westchester Township.

While objections to cemeteries in the immediate vicinity of schoolhouses are largely sentimental, such proximity should be condemned from a sanitary viewpoint also because of the danger of contamination of the school water supply. For this reason wells must often be located at an objectionable distance from these schoolhouses.

Playgrounds.—The great value of regulated physical exercise and play in the open air in connection with school work, which is otherwise a most sedentary occupation, is that it tends to overcome a one-sided development, increases the capacity and ability for work, intensifies the powers of observation, develops presence of mind, overcomes shyness and timidity so common in "shut-in" types of mentality, increases body elasticity, and promotes graceful carriage. Furthermore, the great hope of the future is that, in making school life as attractive as possible through regulated physical exercises during the years of school life on ample playgrounds and with appropriate apparatus, truancy may be reduced in frequency and conditions which make for juvenile delinquency largely eliminated from community life.

It is to be noted that in country districts children often have certain home work to do which is erroneously considered exercise. The fallacy of this lies in the fact that physical exercise by children without the stimulus of mental enjoyment is work which is soon followed by fatigue. Carried further, it produces exhaustion, harmful in effect. Exercise of this character is usually followed by a one-sided physical development.

The school grounds in the rural districts of Porter County, Ind., are without exception of ample area to admit the establishment of playgrounds. In a few schools, however, the areas are greatly restricted by reason of the topography, land unsuitable for other purposes having been chosen for the school site. Furthermore, an attempt had been made in but six schools to make any provision for playgrounds.

Grounds of sufficient area to permit an allowance of 30 square feet per pupil for playground purposes is considered ample in urban communities, where land is expensive. The necessity for so restricted an area is not apparent in rural communities. In Porter County the average school ground space per pupil, exclusive of area covered by the school building, was found to be 976.24 square feet.

Accessibility to school population.—One of the cardinal rules to be observed in the selection of a school site is that it be easily accessible to the greatest number of children. The average time spent by the children of Porter County in traveling to school was 18.8 minutes, and few children spent more than three-quarters of an hour. Thus the schools are within a reasonable distance from the majority of the homes.

Transportation of school children.—Free transportation of school children is practiced in 10 townships, 28 school busses being utilized. The number of children for whom free transportation to school was furnished by the county during 1914–1915 was 345, at a cost of $10,729.80, or $33 for each child.

The ability of the township to furnish free school transportation foreshadows a greater consolidation of schools, which is in accordance with the trend of modern practice in rural districts. By the consolidation of a number of the schools in any one community it becomes possible to employ a few well-equipped teachers in the place of several indifferently trained ones. Moreover, consolidation results in a saving in school lands, constructive material, and operating expenses. It also makes possible the erection of modern sanitary school buildings and the establishment of an efficient system of health supervision without great additional expense to the taxpayer. Porter County is particularly well situated for school consolidation by reason of the good roads which traverse the county in every direction.

The type of school bus used in the county, however, is open to criticism. During inclement weather the children are shut in by tightly-drawn curtains, are closely and promiscuously crowded together under conditions which are favorable to the transfer of communicable diseases, and offer opportunity to the vicious for immoral suggestion. The use of a number of motor-driven school busses on the good roads of Porter County is feasible.

PRIVIES AND SOIL POLLUTION.

Protection from soil pollution.—The prevention of soil pollution by the safe disposal of human excreta is one of the prime requirements for the protection of health, because of the not uncommon presence in such excreta of the living agents of disease. In schools with sewer connection this dangerous matter is carried far away and soil pollution, therefore, so far as the school premises are concerned, is generally entirely obviated. At one and two room rural schools, however, evidences of soil pollution are too commonly met with. Some of them have no privy accommodations; at others, these are badly located, improperly constructed, and poorly maintained.

INSIDE TOILETS.

Inside toilets were found at four schools.[1] At Chesterton, the toilets were connected with a sewer system, at Flint Lake and Hebron Schools with a cesspool, and at Porter with an incinerating apparatus.

In the latter school the toilet is a decided nuisance. The accumulated excreta is incinerated but once a week. At the time of this inspection, April 28, 1915, the odor from this accumulated filth was

[1] In all there were 16 seats for boys and 22 seats for girls.

highly objectionable and could be detected in a classroom situated immediately above. The boys' urinal was connected with a cesspool beneath the basement floor.

Location of inside toilets.—The desirability of locating sewered[1] toilets in the basement or on classroom floors formerly received considerable attention. It is now known that the volatile emanations from sewers and toilets do not carry bacteria, thus removing the most serious objection which could be raised against the practice of placing them on the same floor with classrooms. The advantage of so locating these toilets is that they are more readily accessible, can be provided with daylight illumination, and permit a more direct supervision of both the toilets and the children who use them. Insanitary conditions are more readily detached, and therefore more promptly corrected, than in the case of toilets placed in the basement. Toilets, wherever located, should be adequately ventilated, however, and kept scrupulously clean to avoid objectionable odors.

Toilets were located in the basement in three of the four schools mentioned above. In the Hebron School, however, the toilets were located on the classroom floors, one for each sex.

Number of toilet seats.—The English have adopted the requirement of five seats for each 100 boys, seven seats for each 100 girls and very young children. It is certainly more desirable to have a greater number of toilet seats than are actually necessary than too few. In new constructions this practice makes allowance for an increase in the population, avoids untoward accidents in the case of the very young, whose powers of inhibition are low, and cultivates a habit of regular response to the demands of nature so essential to perfect physical health.

The height of the seats should be graduated from 11 to 12 inches for young children to 14 to 16 for those who are older. These requirements are equally applicable to outside privies.

Toilet plumbing and other considerations.—Because of the thoughtlessness of the majority of children and the numbers involved, the plumbing of school buildings is often subjected to undue strain, a fact well recognized by most architects, who advise the use of fixtures and pipes of extra weight and thickness in school installations. All plumbing for school toilets should be exposed, easily inspected, and readily accessible for rapid repair.

Inside toilet construction.—The requirements for the construction of inside toilets are well understood. In general, for purposes of sanitation, urinals and toilet-room floors should be composed of nonabsorbent, noncorrosive materials. Urinals are usually constructed of slate. The toilet-room floors should never be of wood or con-

[1] It may be safely stated that no toilet unconnected with a sewer system should be located inside the school building.

crete, because the former is more or less absorbent and the latter rapidly deteriorates under action of the acid contained in urine.

A word, however, may be said of the manner of flushing toilets. The type which flushes automatically when the weight of the body is removed from the seat is desirable for very young children and in schools where but slight supervision of the toilet room is maintained. Under other conditions the type which necessitates the pulling of a chain or other device is preferable, because the habitual performance of this act is a part of the child's education in sanitation.

OUTSIDE TOILETS OR PRIVIES.

In the majority of rural schools reliance is placed on outside privies for the safe disposal of excreta. Such privies should be of a sanitary type and screened from view for the sake of privacy. They should be ventilated to remove offensive odors, located sufficiently far from the school building to avoid a nuisance and from the water supply to minimize the danger of contamination through accidental soil pollution and improper upkeep. Privies should be at least two in number at each school, one for boys and one for girls, and should be located on a lower level than the water supply.

Classification of privies.—Privies are classified according to the completeness with which the spread of infection by one or the other methods is excluded, namely, by man and animals, insects, and water. The virtual exclusion of any one of them is rated at 25 per cent, and of all three at 75 per cent.

A total absence of the privy or other installation for the disposal of excrement is rated at zero.

A surface privy open at the back decreases the chances for the spread of infection by the feet of man, and is rated at 10 per cent. A surface privy closed at the back largely eliminates the spread of infections by means of chickens, dogs, hogs, and man, but not rats, and is, therefore, rated at 25 per cent.

The privy with a water-tight receptacle eliminates the spread of infection by seepage and by birds and mammals, and is rated at 50 per cent.

A water-tight receptacle privy closed in the back and thoroughly fly proof is rated at 75 per cent.

The sanitary value of the "pit" privy varies with the soil formation, the contour of the school ground, the height of the ground water level, vegetation, climate, and construction. A privy of this type may rank as low as 10 per cent and lower, or as high as 75 per cent when fly proof, closed in the back, and in an impervious soil.[1]

[1] A leaflet prepared by Prof. C. W. Stiles, of the U. S. Public Health Service, outlining the above classifications of privies, was distributed to the school teachers throughout the county.

According to the classification outlined above, no privy in the county attained a rating higher than 50 per cent. These figures, however, do not accurately represent the efficiency of all the privies so rated, because the nature of the soil and the manner of obtaining water for use in the schools of this county afford greater protection from contamination than would be the case in communities not so advantageously situated.

Sanitary privies.[1]—Two types of sanitary privies are now recognized, namely, removable-receptacle and stationary-receptacle privies. The essential part of a removable-receptacle privy is a water-tight receptacle, screened against flies. An arrangement of this sort can be adapted to any substantial existing privy house after minor and inexpensive alterations. Experience has shown that strong

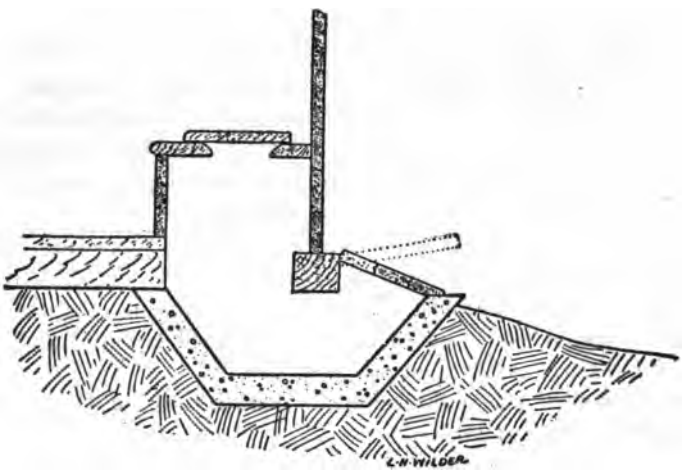


FIG. 1.—A stationary-receptacle sanitary privy with a cement vault arranged for convenient cleaning.

(From Public Health Bulletin 68.)

cylindrical galvanized iron tubs or cans are most suitable for this purpose. Wooden receptacles soon warp, leak, and are entirely objectionable. The adoption of this type of privy necessitates careful attention to ventilation measures to avoid odors. These measures may be supplemented by the use of drying powders, such as lime, earth, or ashes, or by the use of disinfecting solutions.

The principal objection to this type of privy for school purposes is due to the necessity of emptying these receptacles at more or less frequent intervals and of disposing of the contents safely, a task not likely to be regularly performed.

The most suitable manner of disposing of the contents, where privies of this type are in use, is by burial, which should be in the upper layers of the soil, at a depth not greater than 2 feet, in order

[1] Public Health Bulletin No. 68, Washington, D. C.

to take advantage of the natural purifying agencies, animal and vegetable, contained in the soil. The contents of privy receptacles should be buried not nearer than 100 feet to any water supply, in a place which is not likely to be disturbed by animals and which drains in the opposite direction.

The excreta may be disinfected before burial by adding a freshly-made solution composed of 1 pound of chloride of lime to 8 gallons of water.

A stationary-receptacle privy is far more suitable for rural schools than the removable type. In this type of privy advantage is taken of a phenomenon observed in ordinary cesspools—that is, that their contents liquefy, and solid matter is found only near the bottom. This is due to the action of certain living bacteria, which under favorable conditions exert a liquefying action on the solid organic

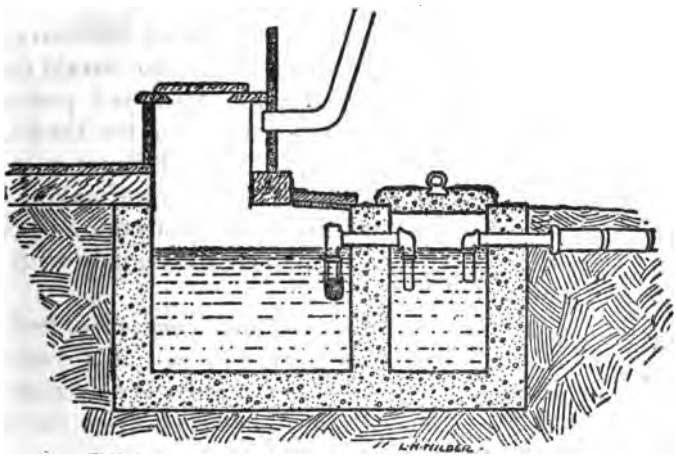


FIG. 2.—An L. R. S. privy with tanks made of concrete and with direct distribution of effluent into top soil.

(From Public Health Bulletin 68.)

matter contained in human excrement. Privies of this type are easily maintained, are sanitary, and usually free from marked odors.

In figures 1 and 2 are shown types recommended by the United States Public Health Service. The former represents a sanitary privy with a cement vault arranged for convenient cleaning, which is suitable for small schools; the latter comprises two tanks made of cement with direct distribution of the effluent into the top soil. A privy of this type may be constructed on a sloping surface in such manner that the effluent pipe discharges into a suitable receptacle where it can be sterilized by heating, or by the use of disinfectants.

As the living agents which bring about liquefaction lose their activity somewhat in cold weather and are killed by disinfectants, the concrete vault should be sufficiently deep to be protected from

freezing, and the use of disinfectants is inadmissible. Privies of this type, in fact all school privies, should be supplied with toilet paper, because it breaks up quite promptly. The use of heavy paper, cobs, and pieces of fabrics should be avoided.

Privies were inspected at 73 schools. Of these the type was open-in-the-back at 9 schools, receptacle in 3, "pit" in 54, and cesspool and brick or cement vault in 8. There were 181 seats for boys and 190 seats for girls.

In figure 3 is shown an unsatisfactory girls' privy, found at one of the schools. Figure 4 represents a privy which is closed at the back, ventilated, and screened for privacy.

The receptacle used in the three receptacle privies found during this survey was made of heavy planking. These receptacles, however, were leaky, full to overflowing with excrement, and apparently had not been emptied since their installation.

The majority of the privies inspected during this survey were of the pit type, which may be considered safe under certain rigid conditions of soil and climate, ground water level and proximity to water supplies. The use of driven wells at most of the Porter County schools, in connection with the glacial drift soil found over land of this kind, offers reasonable protection to the water supply from a privy located more than 100 feet distant, a protection not to be relied on in limestone districts and in marshy regions with a high ground water level.

Distance of privy from water supply and from school buildings.—The privies of a number of schools were located at a distance considerably over 100 feet from the water supply, the average for the county being 90.7 feet. The distance, however, from the privy to the well varied in different townships.

The average distance from the privy to the school building likewise varied in different townships, being 48.3 feet for all schools.

State of repair and maintenance of privies.—Privies were found in good repair in 18 schools, in fair repair in 27, and in poor repair in 23. In addition, privies for girls were found in good repair in 1 instance and in fair repair in 3 other instances, while the corresponding privies for boys were in poor repair at all 4 of these schools.

The cleanliness of privies, however, was found to be good in 7 schools only, fair in 22, and poor in 39. In other words, the upkeep and sanitary policing of the majority of the school privies in use in the county were bad. The privies for girls were found in much better condition than those used by boys. An exception to this general rule is shown in figure 3.

The question of soil pollution has received detailed consideration because of its important bearing on the problems of rural sanitation.

FIG. 8.—Girls' privy at Porter County School.

It is felt that insistence upon the construction of sanitary privies for use at rural schools with due attention to their upkeep will probably do more to impress the rising generation with the importance of observing hygienic laws than any other measure which may be employed for that purpose in connection with school life.

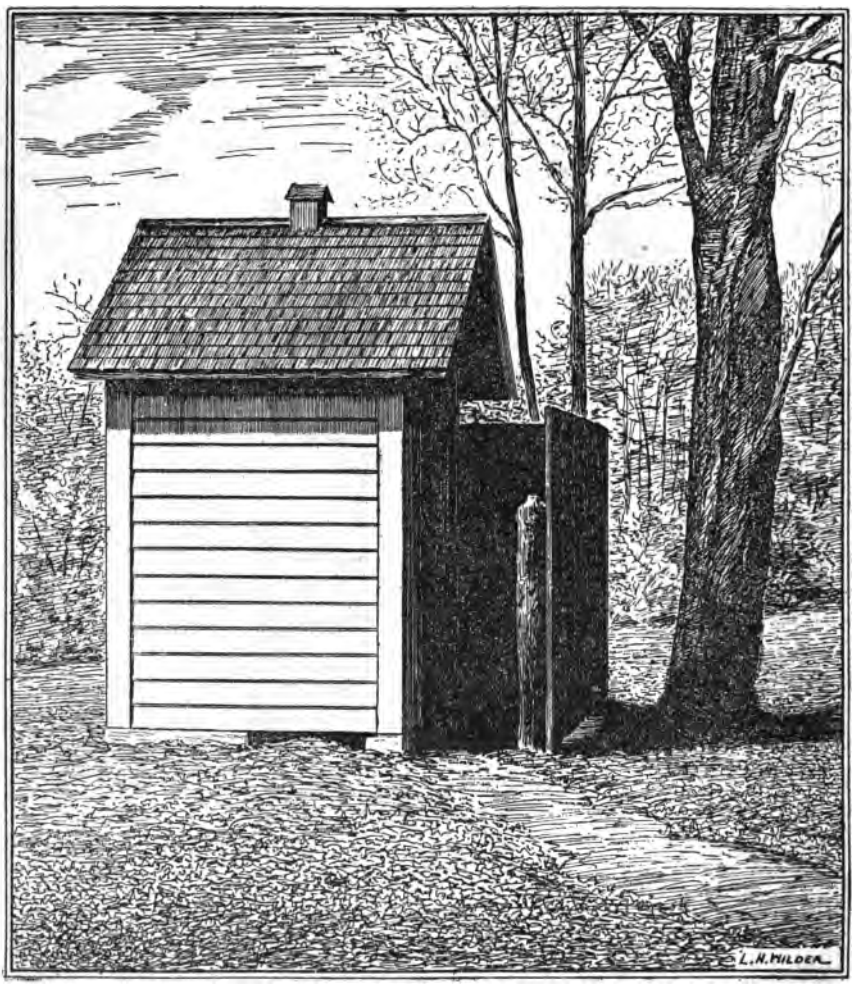


FIG. 4.—Type of "pit privy," ventilated and screened for privacy.
(U. S. Public Health Service.)

SCHOOL BUILDINGS.

NUMBER AND CONSTRUCTION.

At the time of this survey, May, 1915, 77 rural schools were in actual operation in Porter County. Two of these were not inspected, namely, the parochial building at Chesterton and the Hayes

School, Center Township. Of 75 schools, 44.5 per cent were frame structures, 2.6 per cent cement, and 52.9 per cent brick.

Number of stories.—Eighty-nine and three-tenths per cent of all the rural school buildings inspected in the county were one-story structures. Of these one-story buildings, 34, or 50.7 per cent, were frame, and 33 were brick. None of the school buildings of the county consisted of more than two stories with a basement and all of these, eight in number, were of brick.

In all, there were 114 classrooms, of which number 5 were either not in use or used for recitation purposes only. Of the remaining 109 classrooms, 31 per cent were in one-story frame buildings, 27½ per cent in brick or cement structures, and the remainder, 41.5 per cent, were in two-story brick schools. It will be observed that the greatest number of classrooms in any one school was 9. In two other schools, however, the number of classrooms was 8 and 6, respectively.

Basements.—The height of basement ceilings and the distance of the floor level below ground are largely influenced by the use for which the rooms are intended. When used for play purposes, or manual training and domestic science classes, the ceiling should be high, 12 or more feet, to make due allowance for ventilating ducts and other necessary piping. It is desirable in all cases for basements to receive daylight illumination. The top of the foundation, therefore, should be well above the ground level—from 3 to 5 feet, according to whether or not manual training and domestic science classrooms are to be located in the basement.

A record was kept of the illumination of all basements inspected during this survey. These were classified as good in 12 schools, fair in 6, and poor in 5. The term "good" in this classification is relative, because in no case classified was the basement used for classroom purposes, which would require a better natural illumination than was found in any basement inspected during this survey.

All school basements should be waterproof. Failure in this respect results in dampness. The basements were practically waterproof in 16 schools and without any attempts at waterproofing in 7 others. This latter condition was due largely to the material used in floor construction. In 16 instances the basement floors were of cement, brick in 3, and earth in 4.

Toilets were located in the basements in but three schools. The disadvantages of this system have been discussed elsewhere in this report. (See p. 14.)

The ventilation of the basements was accomplished by windows in 21 schools, and in two others they were connected with the general ventilation system. At all schools with artificial ventilation installations, however, insufficient precautions were taken to exclude cellar

air from the fresh-air intakes, a matter discussed more fully in the section of this report dealing with ventilation. (See p. 59.) Finally, seven basements were found in a dirty condition that should not be tolerated because of its bad example in sanitation.

Orientation of school buildings.—The direction in which the school building faces influences largely the arranging and distributing of classrooms so that a maximum illumination efficiency may be secured with the greatest comfort to the eye. There is also the necessity of providing for the admission of sunlight to each classroom during some hour of the day because of its germicidal properties. Classrooms, therefore, which have north, northwest, west, southwest, and south exposures receive the least sunlight, in the order mentioned.

The orientation of the school building a few points off the compass permits the easiest arrangement of classrooms for the purposes mentioned. The roads of Porter County, however, either follow or parallel section lines: that is, they are north and south, and east and west. For this reason the school buildings set square with the compass, otherwise their relation to the school plot would be an irregular one. The majority of the Porter County schools are one-room structures which readily lend themselves to classroom orientation best adapted to the purposes of daylight illumination, irrespective of the direction in which the building faces.

The orientation of the school buildings of the county was as follows: Ten faced north, 23 east, 25 south, and 17 west. Of 109 classrooms investigated from the standpoint of orientation, 35, or 32.5 per cent, faced north; 21, or 19.2 per cent, east; 23, or 21.1 per cent, south; and 30, or 27.2 per cent, west.

Date of construction.—The greatest number of sanitary defects met with during this survey were in connection with very old buildings, erected long before the development of school hygiene as a factor in the education, sanitation, and economics of communities. In a measure this is fortunate, because it encourages school consolidation by lessening the objection to the abandonment of buildings which have almost passed the limit of usefulness.

Ten of the rural school buildings were less than 5 years old, 6 between 5 and 10 years, 16 between 10 and 20 years, and 43, or 57 per cent of the total number, were more than 20 years old.

Attempts at renovation had been made in a few instances. In general, the expense of remodelling a number of these old buildings to meet the requirements of school hygiene would be nearly as great as new construction. This is another argument in favor of consolidation of rural schools as an economic measure, as is the fact that the attendance at some of these schools was very small. In one school there were only 4 pupils present and but 6 in another. Never-

theless, the operating expenses of these schools are as great as that in schools with larger attendance and more modern equipment.

Foundations.—It is not unusual to find one-room school buildings in remote districts on inadequate foundations. The most serious fault in this respect is the use of pillars, an arrangement that gives free sweep to the winds beneath the buildings, causing cold floors, cold feet, and adding materially to the cost of heating.

The foundation of all small school buildings should be closed in and provided with screened ventilation openings. The Indiana law requires that the top of these foundations shall be at least 3 feet above the ground level to provide against damp and rotting floors.

The foundations of all the rural schools of the county were of the closed-in type. In one or two instances these were in poor repair.

Roofing.—The material used for the roofing of school buildings is important from the standpoint of fire protection and frequency of renewal. Slate roofing is probably the most desirable in this respect. The roofs of nine schools of the county were of this type. In spite of its desirable qualities, the use of slate for roofing is a doubtful economy in small one-story school buildings, where it may be easily broken by children at play. The repair of a slate roof necessitates the employment of one skilled in this work and not usually available in rural communities.

The greatest number of rural schools, 64 or 85 per cent, had shingle roofs. Two had tin roofs.

STATE OF REPAIR.

The upkeep of school buildings is as necessary an educational and sanitary measure as the establishment of hygienic structures. The cost of maintenance and repair constitutes not an inconsiderable part of the operating of school plants, but neglect of this duty is obviously a false economy.

The state of repair of 43 buildings inspected was good, of 24 fair, and of 8 poor. This classification takes into consideration the grossest conditions of structure only, without reference to the number of schools in need of interior redecorations.

FIRE PROTECTION.

Brief consideration only is given in this report to measures of fire protection. The requirements for this purpose are incorporated in the building codes of the several States.

As a life-saving measure protection against fire in small one-story rural schools is of secondary importance to insurance against property loss. It is inconceivable that a fire should gain sufficient head-

way in a building of this type effectually to close the avenues of exit before the building could be emptied.

Nevertheless, the natural increase in population and the modern tendency to consolidate rural schools call for larger buildings of more than one story, a type of construction demanding greater safeguards against fire for the protection of life. Briefly, the extent of fire protection afforded in any one building is measured by the materials used in its construction, height of the building, presence or absence of fire escapes, location and arrangements of exits, stairways, and classrooms, heating system used and isolation of the heating apparatus in fireproof structures, location of the heating apparatus with respect to entrances, installation of fire plugs and hose, provision of hand grenades and patent fire extinguishers, and finally, institution of fire drills.

It is exceedingly difficult to make a school building completely fireproof. The extent to which such material is employed in schoolhouse construction will depend largely on the accessibility of different localities to the sources of supply.

The higher the building the greater the danger to life in case of fire. The Indiana law limits the height of buildings used for school purposes to two stories and a basement. All the two-story school buildings inspected during this survey were of brick construction. The greatest number of highly inflammable buildings were one-story frame structures, which constituted 44.5 per cent of all the rural school buildings in the county. No fire-fighting apparatus was observed in any rural school building in the county, a condition which should be remedied.

Five buildings were provided with fire escapes of the open-ladder type, which in one case consisted of a simple iron ladder without a platform leading from the classroom window to the ground. The open type of fire escape doubtless answers the requirements of rural communities where the school attendance is relatively small and the children accustomed to climbing. In congested districts, however, the inclosed type of fire escape is desirable.

Buildings with central heating plants should have the heating apparatus placed in a fireproof inclosure. The new school at Hebron is equipped in this manner. The heating plant of the Crisman school, consisting of furnaces located in the cellar, is a distinct menace by reason of the close proximity of the furnace top to the low wooden ceiling. The heating apparatus should be located as far as possible from exits to avoid cutting off avenues of egress in the case of fire originating at this source.

The value of fire drills, as a life-saving measure, has been demonstrated time and time again in the case of fire. This practice enables the building to be emptied not only in the shortest possible time, but

in an orderly manner necessary to avoid panics and injury. Aside from these considerations fire drills are of distinct value for teaching self-reliance in time of stress.

Lastly, the arrangement of building exits which open out and are provided with fire bolts is a further precaution for the protection of life in case of fire. Entrance doors opening in the wrong direction were observed in 53 per cent of the schools of the county, 38 opening out, 40 opening in.

Outside doors opened into halls in 29, or 34.7 per cent, of the schools; into vestibules in 37, or 49.3 per cent; and directly into the classroom in 12, or 16 per cent.

WATER SUPPLY AND LAVATORY FACILITIES.

Due attention must be paid to the water supply of schools to secure a supply which is free not only from contamination with disease agents, but from other objectionable features that might cause children to refrain from its use in desirable quantities.

The detection of the presence of harmful agents in drinking water requires special facilities which are lacking in nearly all rural communities. Therefore, especial attention must be paid to the installation of sanitary privies to protect water supplies.

Sources of water supply.—Rural schools secure drinking water largely from shallow wells, which frequently become contaminated. The water obtained in this manner is that part of the rainfall which sinks into the ground until an impervious layer of clay or rock is reached and which finds an outlet at lower levels. A shallow well taps this flow of ground water and drains an area in the form of an inverted cone, with the point at its bottom. The diameter of the area thus drained is variously estimated by authorities to be 20 or more times the depth of the well, depending on the nature of the soil. The soil of Porter County, however, is a natural filter, so that the protection afforded the water from natural means is far greater than that afforded by the sanitary conveniences most frequently found at the schools.

Unless due precautions are taken, the shallow well is a constant source of danger. It should be protected from surface drainage to a depth of several feet and located as far as practicable from sources of contamination.

Three of the rural schools of Porter County are connected with the town water systems, namely, Flint Lake, Chesterton, and Porter schools. The new school at Hebron has been fitted for connection with the town supply, which, however, had not been introduced at the time of this inspection. Two other schools are supplied by wells from 125 to 130 feet in depth, respectively.

Driven wells.—The water used in nearly 75 per cent of the rural schools of the county was obtained from shallow driven wells.[1] Thirteen, or 17.3 per cent of all the schools of the county, were without wells. In these cases all water used for school purposes was brought from neighboring farmhouses, in some instances one-quarter of a mile or more distant. This practice is bad because of the possibility of obtaining water from infected wells.

The wells of four schools were not in use, and at nine other schools the pumps were out of order. This increased the number of schools taking water from neighboring farmhouses to 26, or nearly 35 per cent of all the rural schools in the county.

The distance at which the well is located from the privy is a factor in the freedom from contamination of the water supply. The average distance separating the well from the privy for the county was 90.7 feet, as stated elsewhere (p. 18).

Wells should not be located near the entrance to school buildings. In places where due care is not given to the drainage of waste water, the space surrounding the well becomes an unsightly mudhole, from which dirt may be carried directly to the schoolroom. Furthermore, the floor sweepings added to this mass increase the liability of such wells to contamination with infectious material.

At four schools in the county the well was located within 6 feet of the building and under the basement in two other instances,[2] the average distance for all schools of the county being 32 feet. The objection to locating the well under the basement is largely due to the difficulties of repair and to the dampness by water wasted on the basement floor.

Protection from surface drainage.—The protection of the wells of the county from surface drainage seems to have been influenced largely by the desire to avoid a muddy approach rather than from the viewpoint of sanitation. This is indicated by the use of boards for this purpose at a large number of the schools.

In figures 5 and 6 are shown types of pump installations and the extent of protection from surface and waste water drainage. In but few instances has this been done in the proper manner.

In a number of instances the upper part of the well consisted of a walled-in pit several feet in diameter, ranging from 6 to 8 feet in depth, through the bottom of which the well had been driven. In some cases the bottom of this pit contained a layer of charcoal for

[1] Driven wells are those constructed by driving an iron pipe into the soil and completed by fitting the pump to its top after being driven to such a depth as to obtain a sufficient flow of water.

[2] Two schools other than the ones mentioned, namely, Kouts and Porter schools, had wells located under the basement. These wells, however, were no longer used to supply drinking water.

the filtration of waste waters. The boards covering these pits in most instances had been disarranged, and in consequence they served as a catchall for very offensive substances.

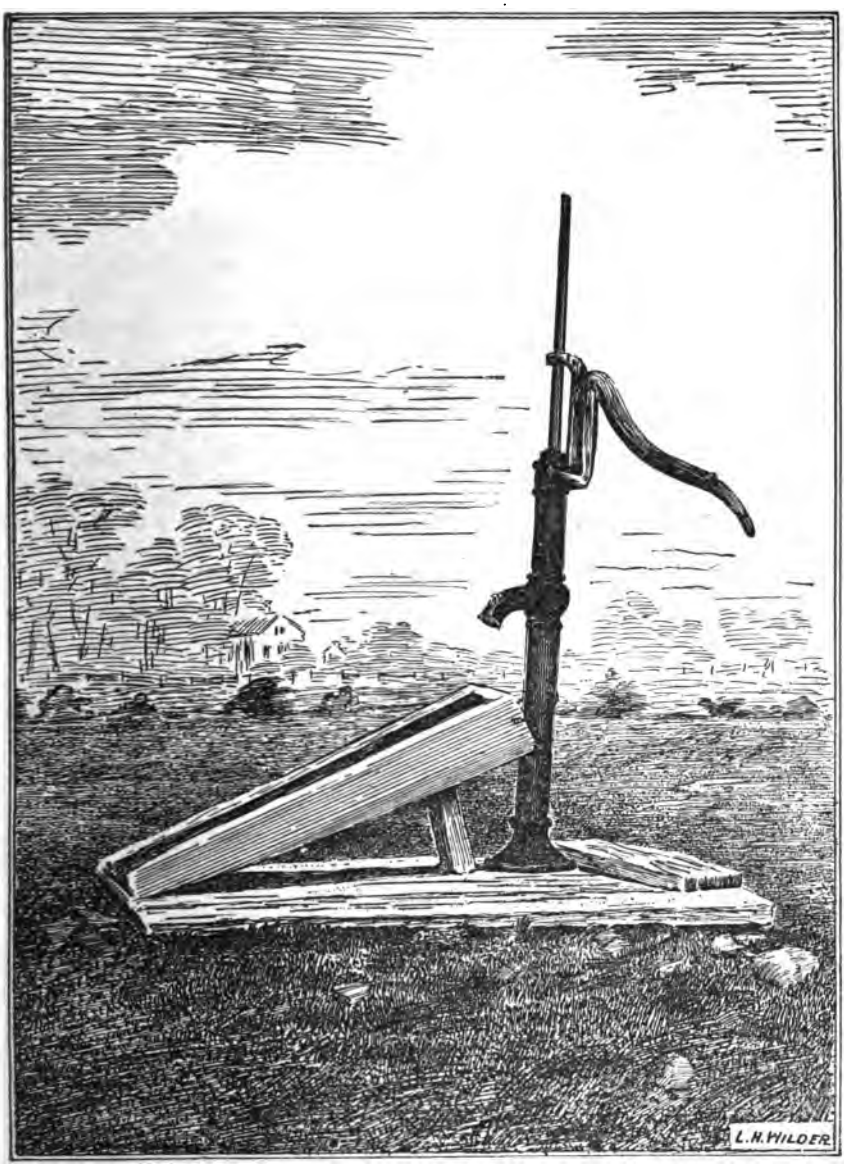


FIG. 5.—Shallow-driven well with trough for drainage of waste water.

Water containers.—Sanitary drinking fountains of the various stationary types were found in seven schools. Of these, two were out of order and one was not in use.

In all other cases the children drink at the well, a common practice also in a number of schools provided with water buckets and

FIG. 6.—School well surrounded by shallow pit and board protection from surface drainage.

drinking fountains. Bubbling-fountain attachments to the town water supply were observed in Chesterton and Porter schools. The new school at Hebron is now equipped in like manner.

Facilities for washing hands.—Children should be taught the value of personal hygiene in the maintenance of health. This is especially true of the necessity of cleaning the hands frequently. They become soiled during play, while attending to the calls of nature, through handling soiled objects, and are carried immediately to the face, perhaps introducing infectious material into the mouth, nose, or eyes. In the same manner books, pencils, and other objects may become infected.

Sinks were provided in three schools, and were a part of the water and sewer systems. At 56 schools, practically 75 per cent of the total, common washbasins were provided. At three of these schools the basins were frankly, and in a number of other instances obviously, not in use. Paper towels were provided at eight schools, notably at all six of the schools in Pleasant Township. Individual or "family" towels provided by the parents were reported in use at three schools, common towels at 41.

Use of common drinking cup.—The use of the common drinking cup in public places is not prohibited by law in the State of Indiana, notwithstanding they are dangerous to health. Prof. Davison,[1] of Lafayette College, found human cells scraped from the lips of persons while drinking so numerous on the upper third of a glass in use only nine days that the head of a pin could not be placed anywhere thereon without touching one or more of these small pieces of human tissue.

More to the point, however, is that he found germ cells left by the saliva deposited while drinking in such a quantity that not less than 100,000 bacteria were present on every square inch of this glass. He found by special methods that a number of these organisms were of the kind which produce disease.

During this survey the common cup only was in use in 14.3 per cent of the rural schools of the county, individual cups only in 42.5 per cent, and individual cups by some of the pupils and the common cup by the others in 40 per cent.[2] In most cases, however, the so-called individual cup was a "family" cup used by the members of the same family. The practice of lending the individual cups to others was found on inquiry to be quite common, so that these were essentially common drinking cups.

The use of individual cups, with a suitable place for keeping them and due explanation of their need, should be imperative in all schools as an object lesson in personal hygiene.

[1] Prof. Davison: Technical World Magazine, August, 1908.

[2] Water buckets in 24 schools, common cups in 31, individual cups in 52.

CLASSROOM EQUIPMENT.

The essential features of the classroom equipment from a hygienic standpoint are briefly: The number, type, and arrangement of desks; the location of blackboards; their composition, width, and height above the floor level; and provisions for the collection of dust and the use of window shades, their color and adjustment. Preliminary to a discussion of these features of classroom equipment brief mention may be made of classroom walls and floors.

CLASSROOM WALLS.

The color and finish of classroom walls are of prime importance from the standpoint of illumination. In general, classroom walls should be of hard plaster and tinted some pleasing color of high reflection coefficient, using oil paint. The finish should be without gloss to avoid glare. The use of wainscoting is intended primarily for the protection of the walls from injury. For this purpose some form of tiling may be used in halls and corridors. Classroom walls, however, are not subjected to the same danger of mutilation; and the wainscoting is used largely to tone down the light reflected by the lower portion of the walls. This can be accomplished readily by painting a strip of the plastering to the necessary height, about 4 feet above the floor level. Its color should have a reflection coefficient not higher than 30.

The use of wooden wainscoting is undesirable in classrooms because it adds to the inflammable material. Painted burlap for this purpose is also undesirable. This substance presents a roughened surface for the collection of dust and does not readily lend itself to washing.

All corners, as well as the junction of the walls with the ceiling and floor, should be rounded. This arrangement is intended to avoid the collection of dust and to permit washing the walls effectively.

FLOORS.

The use of wood in the construction of classroom floors is advocated from the standpoint of comfort. The flooring material in all cases should be narrow, not over 2 inches wide, and laid as tightly as possible, using concealed nails.

To reduce dust the floor may be oiled, and where vacuum cleaners are not available a sweeping compound may be employed. The Indiana law requires the oiling of classroom floors twice during the school year. Oiling of floors was observed in nearly all the schools inspected to the extent of at least once annually, generally at the beginning of the school year. Further consideration of dust and its effects will be given under another caption (p. 59).

SCHOOL DESKS.

It is not possible to dissociate the consideration of school desks from posture in school children and the effect of faulty posture on health. The deformity most usually associated with faulty posture is some form of functional spinal curvature. For this reason posture and postural defects will be considered in another section of this report which deals with defects among school children (p. 88).

Irrespective of the cause of postural defects, many of them may be overcome by appropriate measures during the period of school life. Of these measures may be mentioned the adjustment of the desk to the child. Probably upon no single physical feature connected with schools have such definite conclusions been reached as upon the relation of school desks to children. It is now quite generally agreed that the height of the desk should be so adjusted that the arms of the seated child will rest naturally on the desk in an easy position, with the elbows at the side.

The size of the desk top should vary according to the grade. That advocated in the Boston code is as follows: Grades I to III, 12 by 18 inches; grades IV to VI, 15 by 21 inches, and for grades VII to VIII, 16 by 23 inches. The slope of the desk should vary from 15° for writing, to 30° or 45° for reading. These regulations are intended to cause the child to maintain an upright position and to prevent his bending the head unnaturally while performing school tasks.

The desk seat should be adjusted to allow the feet to rest squarely on the floor when the legs are flexed at right angles. It may be flat or curved to fit the buttocks. The front edge should be rounded. The depth of the seat from front to back should be two-thirds the length of the thigh.

The relation of the seat to the desk has been described as minus, plus, and zero, depending on whether the front edge is in front, to the rear, or on a line with a perpendicular from the edge of the desk to the floor. This measurement should never exceed 1 inch in any direction. The plus arrangement has been found most suitable for general school purposes.

The distance from the seat to the top of the desk should equal about one-sixth of the height of the body. The back should be placed at right angles to the seat and extend to the shoulder blades, curved concavely from side to side and convexly from above downward, giving support to the lumbar spine. These desk requirements cause the child to assume an upright posture, prevent sprawling and the assumption of slouchy postures, and place the work at the proper angle and distance for visual comfort. These requirements, however, cause considerable restraint to the natural activities of young children and therefore necessitate frequent rest periods, especially in the lower grades.

Adjustable desks.—The use of some form of adjustable desk is necessary to fulfill all the requirements of an ideal school seat. The frequency of adjustment depends upon the sex and age of the child. Adjustments should be made, however, in all cases at the beginning of the school year. As a rule, girls grow more rapidly in height between the ages of 12 and 14 and boys between the ages of 14 and 16. The girls in Porter County schools, however, attain their most rapid growth from 12 to 14 and the boys from 13 to 15 years. Special care should be given to the more frequent adjustment of desks to children at these periods of rapid growth than at other age periods.

Adjustable desks are in use in only 9.15 per cent of the classrooms of the county. Most of the classrooms with nonadjustable desks, however, were supplied with desks of various sizes for children of different heights.

Number and arrangement of desks.—The average number of desks per classroom for the county was 33.7, influenced by the necessity of seating an undesirable number of children in the one-room schools of the county. The number of seats provided, however, was in excess of the children present. Ten classrooms had adjustable seats; 95 nonadjustable.

Desks should be arranged with a view to obtaining the greatest visual comfort and separation of the pupils in the interest of health. The desks should be arranged in parallel rows, with windows to the left and rear. To avoid shadows the smallest seats should be nearest the windows and successive rows in regular gradation. Desk rows should not be nearer the wall than 24 inches. Aisles separating desk rows should be 18 to 20 inches wide, according to the grade.

The average width of aisles separating desks from classroom walls in the county was as follows: Right aisle, 39.7 inches; left aisle, 29.7 inches; front, 7.8 feet; rear, 3.3 feet; and the average distance between desk rows was 21.4 inches. In a number of schools, however, the desks were placed as closely as possible to the windows and walls, a very undesirable situation from the standpoint of illumination, and also undesirable because this arrangement interferes materially with the cleaning of floors. Furthermore, window ventilation can not be practiced without subjecting the children occupying these seats to objectionable drafts.

WINDOW SHADES.

The requirements to be fulfilled by window shades are that they be translucent, be adjustable from either top or bottom, and be kept in good repair. A window shade which transmits colored light rays is undesirable. The translucent shade should be supplemented by an opaque one between it and the light source to shut out direct sunlight.

Window shades adjustable from top and bottom were found in 51.5 per cent of the classrooms of the county.[1] There were no shades whatever in three schools, and the shades were in poor condition in at least nine other classrooms. The latter statement is conservative, because a number of window shades in other classrooms were badly faded and require replacement at an early date. All of the window shades in the county were semiopaque, the predominant colors being some shade of green or yellow.

In a large number of classrooms inspected during this survey the lower sashes of windows were more or less obscured by muslin window curtains. No doubt this arrangement imparts a more homelike aspect to the classroom; but the practice is objectionable, because these curtains not only reduce the amount of daylight admitted to the classroom but do so increasingly by reason of the accumulation on them of dust and dirt.

BLACKBOARDS.

The use of blackboards is so necessary to classroom instruction that careful attention should be given to their construction, width, height, distance from the floor level, and location with respect to windows.

The use of wood for this purpose is no longer tolerated in well-regulated schools. The surface of such boards soon acquires a polish which causes glare that markedly interferes with vision. Composition blackboards are now on the market which give good service for a time. A number of these, however, have no very great lasting qualities and soon acquire an irregular surface which interferes with both writing and vision. Liquid slate applied directly to the wall or to a concrete surface requires frequent renewal, pending which unsatisfactory service is given.

The cheapest blackboard material in the end is slate. To meet the requirements of an ideal blackboard, however, the slate must present a dull black surface.

Slate was used for this purpose in 89, or 85.5 per cent, of the classrooms of the county. Composition blackboards were used in 7 classrooms, wood in 1, and a painted wall strip in 8 others.

Blackboard dimensions.—The statement that a classroom can not have too much blackboard space needs qualification, because it was made evidently without due regard to the requirements of classroom illumination. The light absorption by black surfaces is so great that an undue proportion of blackboard space reduces the amount of light diffusion in the room. Where the demands for large black-

[1] Window shades in 54 classrooms were adjusted from top, in 46 from top and bottom. In 67 they were green and in 30 tan.

board surfaces are imperative, however, the blackboards might be fitted with curtains of light color adjusted to rollers, which could be drawn when the boards are not in use.

The standard width up and down of blackboard surfaces is 4 feet, the average for the county being 41.6 inches. In practice it has not been found necessary for the top of the blackboard to reach a higher level than 6½ feet above the floor.

Blackboards in classrooms intended for the primary grades should be placed at a lower level than in the case of those for the higher classes. When placed too high the arms are raised to a height while using them which soon induces fatigue. An acceptable measurement from the floor level now advocated is 26 inches for the primary grades and 30 inches in the higher grades. The average distance from the floor for all grades in the classrooms of the county was 33.5 inches, ranging from 24 to 40 inches.

Location of blackboards.—Blackboards should never be placed between windows nor in obscure parts of the classroom. In the former position the contrast between this dark surface and the window brightness causes glare which is so great as to render such boards practically useless for classroom instruction. In the latter case the obscurity of that portion of the classroom is intensified by the light absorption by these black surfaces. The best location for the blackboard is the front wall of the classroom. This space may be supplemented by utilizing the right-hand wall. In both of these locations blackboards receive good light and are visible without discomfort to the entire class. Blackboards should never be placed on walls having windows or on the rear wall of the classroom under any circumstances. In classrooms lighted from one side only, the location of blackboards on the opposite wall causes great light absorption, which may be avoided by the use of curtains in the manner already described. In 36 per cent of the classrooms of the county the blackboards were located with windows to the left and opposite, on either side in 33 per cent, on either side and opposite in 21 per cent, and to the right and opposite in 7 per cent.[1]

Chalk troughs.—Classrooms may be protected to a large extent from blackboard dust by the use of shallow troughs, from 3 to 4 inches wide, which are placed at the bottom of the blackboards and covered by a detachable wire screen of coarse mesh. This latter arrangement protects the fingers, crayons, and erasers from the accumulations of powdered chalk. Dust from these sources is irritating to the respiratory mucous membrane. These receptacles, therefore, should receive careful attention and be emptied daily after school hours. Practically all of the classrooms of the county were equipped

[1] Windows to right in 7 rooms, to left in 36; blackboards between windows in 56, windows opposite in 70.

with some arrangement for this purpose; but few of them were protected by wire screens.

DAYLIGHT ILLUMINATION OF CLASSROOMS.

Studies were made of the daylight illumination of 109 classrooms in 75 rural schools during the course of this survey. Faulty illumination may cause lasting injury to the visual health; for instance, not only may it aggravate the condition of nearsightedness in young children, but it is also considered by many authorities a cause of this condition.

Defective illumination of classrooms has an adverse influence also on the activity of the intellectual processes of children. The young child requires greater intensity of illumination than the adult to enable it to interpret the meaning of written or printed characters. One reason for this is physiological. Another is that these characters are familiar to an adult, and are, therefore, easily recognized and interpreted under conditions of poor illumination. Furthermore, the mind of the young child functionates largely in proportion to the volume of stimulation received through the eye. Whenever, by reason of faulty illumination, extra effort is required of the ocular muscles to accommodate for the recognition of written or printed characters, fatigue is soon produced, and the intellectual development of the child is hampered.

Faulty illumination causes the assumption of injurious postures and the acquirement of a "postural habit" that may aid indirectly in the production of postural defects which may ultimately act injuriously on the general health in later life. In fact, the faulty posture frequently assumed by the child under conditions of poor illumination has been assigned by a number of medical authorities as a causative factor in the production of nearsightedness.

SECURING AN ABUNDANCE OF ILLUMINATION.

The whole subject of illumination is highly technical, and the practical application of the principles involved, in so far as daylight illumination is concerned, is not easy, due to the absence of working standards occasioned by the numerous accommodation factors involved. In recent years, with increased knowledge of the fundamental principles of illumination, the illuminating engineer and the architect have deduced certain requirements for the daylight illumination of classrooms. The object of these requirements is to secure an abundance of light from the right direction, to insure a maximum diffusion with the avoidance of objectionable glare, and to make suitable provision for its regulation by increasing or diminishing the amount of light admitted as necessity may demand.

Window area.—In order that sufficient light may enter classrooms properly to illuminate all desks under all conditions, certain measures of illumination have been adopted from time to time. Perhaps the most widely accepted of these, at least in this country, is the one

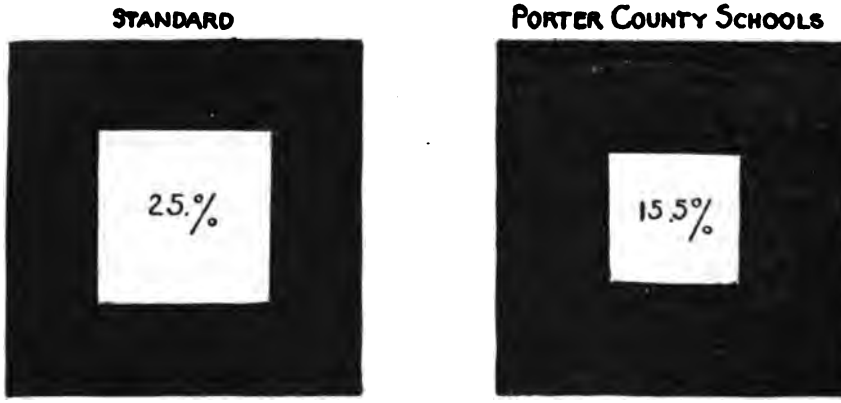


CHART 1.—Standard ratio of glass area to floor space of schoolrooms and average ratio in Porter County.

which requires the glass area of classroom windows to be not less than one-fourth the floor space of the classroom. In Porter County the average ratio of glass area to floor space was 15.5.

In charts 1 and 2 are shown graphically the standard ratio of glass area to floor space, the average for all the rural schools of

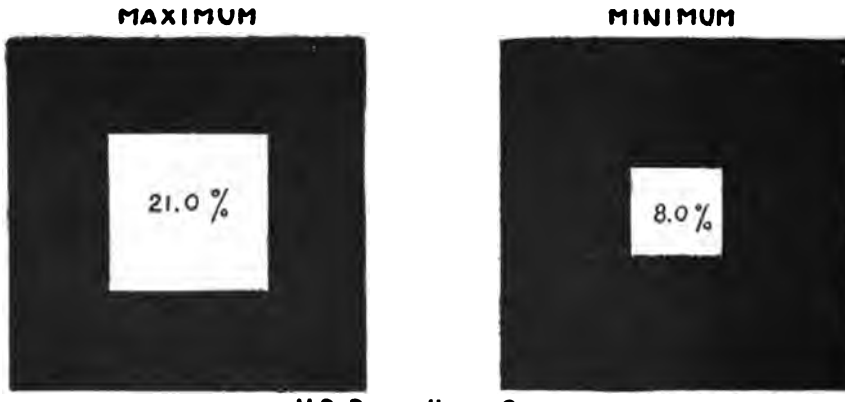


CHART 2.—Maximum and minimum ratios of glass area to floor space in classrooms of Porter County.

Porter County, and likewise the county maximum and minimum. It will be seen at a glance that even the maximum architectural provision for classroom illumination is considerably less than the generally accepted standard.

It must not be supposed that the desk illumination of all the rural schools of Porter County is as deficient as indicated by the foregoing charts. Actual photometric observations made in a number of schools representing county types show that this is not the case. The apparent discrepancy is due to the relatively small number of desks, which may therefore be grouped near to windows and occupy a space commensurate with lighting efficiency.

In chart 3 is given the desk illumination of the fifth grade in the Chesterton school, Westchester Township. It will be observed that this classroom, with a window-glass area of 17 per cent, had a high desk illumination, nowhere less than 23.3 foot-candles. These observations were made under favorable meteorological conditions.

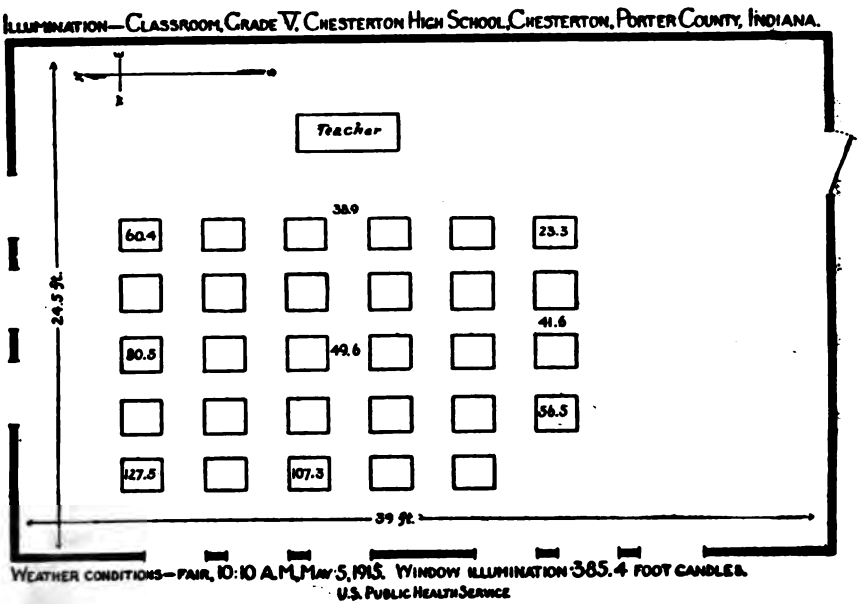


CHART 3.

The high illumination intensity, however, was due largely to windows on the left and rear of the seated pupils and to the location of the classroom on the second floor, which permitted an unobstructed sky surface.

The high illumination intensity shown in this classroom calls for regulation by appropriate means.

Chart 4 is particularly instructive because it shows the necessity of a different desk arrangement in closer proximity to windows and the serious consequences from the standpoint of illumination of classrooms of great depth in a direction opposite the light source. In cloudy weather it is necessary to supplement the illumination of

this room by artificial means, an exigency which could be obviated in a measure by grouping the desks nearer the windows.

The utilization of this standard, however, is conditioned by certain more or less rigid restrictions. In the first place, it must not be forgotten that the illumination of a given desk in a classroom is inversely as the square of the distance from the source, which in this instance is the classroom window. The adoption of this standard of illumination, therefore, fixes the width of classrooms within very definite limits, so that no desk should be removed further than 20 feet from the source of light under average conditions of one-sided illumination.

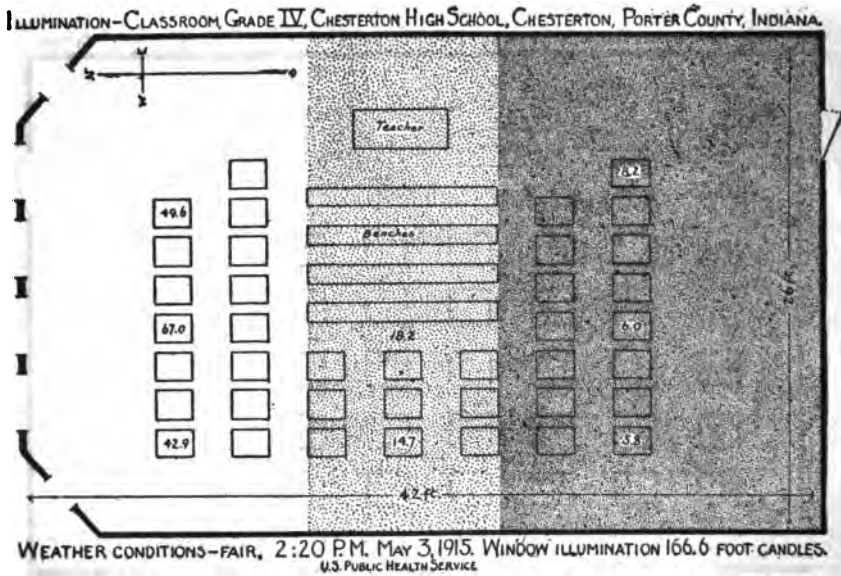


CHART 4.

The amount of light entering classroom windows of a given area is modified by the angle of incidence, by the proximity and color of neighboring buildings, by the presence or absence of shade trees, by projecting eaves, by variation in the number of sunny days, by the distance of the upper edge of the window from the ceiling, and even by the thickness and quality of the glass used in windows.

Nearness of neighboring buildings hardly enters the problem of rural school construction. Nearness of shade trees, however, may seriously interfere with the admission of daylight to classrooms.

Visible sky vault.—In order that the pupil may receive the light necessary for the illumination of his desk, a measure has been suggested which demands that the child shall be able to see a part of the sky vault from his seat. It has been suggested that this sky

surface be measured by a reduced solid angle of not less than 50 square degrees. This provision presupposes that the angle of incidence of luminous rays, that is, an angle formed by a plane from the upper surface of the desk cutting the upper edge of the window, and another plane from the same point cutting the lower edge of the visible sky surface, should be not less than 5°. Moreover, the angle of elevation of the luminous rays, that is, the angle included between the upper of these two planes and the horizontal, should not be less than 25°. These and similar measures of illumination, however, admit of wide variations, because they take into consideration direct light only, without reference to the important factor of reflected light from whatever source.

Photometric standards.—The adoption of a standard of desk illumination based on actual photometric observations is the most rational of all requirements to secure the proper illumination of classrooms. The amount of light so measured should not be less than 10 foot-candles at any desk under all conditions. The measure suggested is higher than that usually advocated. But it must be remembered that it is easier to regulate an excess of light than to provide for more after the school building has been constructed.

One of the difficulties attending this standard, however, is the necessity of working out all architectural features affecting illumination, because of the wide daily and seasonal variation of meteorological conditions in different sections of the country.

On the other hand, there are certain architectural features having a direct bearing on the amount of daylight entering the classroom which should not be omitted under any climatic conditions. Not only is it desirable to have a certain extent of sky surface visible from the desk, but the light proceeding from these sources should enter the classroom at as great an angle of inclination as possible. For this reason the upper edge of all windows should reach the ceiling so that the rays of light entering may approach more nearly the perpendicular and insure a maximum of diffusion with the elimination of objectionable glare. On an average the top of the windows were 25.6 inches from the ceiling and the lower edge 35.2 inches from the floor.

Less reliable measures of illumination efficiency.—In remote districts and even in communities having model facilities for illumination, it is very desirable to provide teachers with some simple and practical guide for determining the illumination efficiency in classrooms. Even where proper facilities have been provided, good illumination depends largely on the efficiency of the janitor's service and the personal equation of individual teachers. For example, the absorption of light transmitted through ordinary window glass is about 10 per cent. This loss is greatly augmented where the cleaning of win-

dows has been neglected and dust and dirt allowed to accumulate on the window panes. Not infrequently, opaque window shades are drawn to exclude excessive illumination and left in this position when the necessity is past. Curtain fixtures readily get out of repair and remain so through neglect of the janitor or school authorities, and are thus a disturbing factor in the proper illumination of the classroom.

Probably the most readily available measure suggested is the ability of the normal eye to read diamond type readily at a distance of 20 inches. A framed card bearing one or two paragraphs printed in diamond type may be utilized for this purpose.

It has also been suggested that a row of square dots, 1.4 millimeters each way, separated by 1.4 millimeters, be added to the ordinary test card. Under usual conditions these dots are seen as a row of squares at a distance of 20 feet. If the light be poor, however, the dots become fused into a continuous line.

These tests are purely relative and serve solely to call attention to possible deficiencies of illumination. The use of such tests by far-sighted persons or by persons more than 40 years of age would call for correction by glasses.

POSITION OF ILLUMINATION SOURCE WITH RESPECT TO DESK ARRANGEMENT.

The provision of an abundance of light is but one of the requirements for satisfactory illumination. Daylight must be admitted from the proper direction also if the maximum effect with the least discomfort to the visual apparatus is to be secured. Classroom windows, therefore, must never be located in such a manner as to permit light to fall in the faces of the seated children, nor should they be opposite each other because of the cross lights and confusing shadows produced by this arrangement.

Unilateral window arrangement to the left of the seated pupils is quite generally adopted in this country. There are two serious objections to this practice. In the first place, frequently the shadow of a very stout child, seated between the window and the desk occupied by a child who is much smaller physically, reduces the illumination of the latter's desk. In the second place, in all cases where unilateral illumination is practiced, the desks immediately adjacent to the windows at times receive illumination of so great an intensity that it is hard to regulate without throwing a part of the classroom in shadow. The situation is comparable to artificial lighting, where better illumination is secured by the proper distribution of a number of small lighting units than by the use of a few concentrated units. Two-sided classroom illumination, by windows to the left and rear of the seated pupils, is therefore preferable. This arrangement

secures a more uniform light distribution which may be more easily regulated with respect to intensity than is the case with unilateral illumination.

The sole reasonable objection to this arrangement of classroom windows is the annoying effect on the teacher, who is usually seated facing windows when they are located in the rear walls of the classroom. There is no valid reason for this usual arrangement of the teacher's desk, which seems to be a matter of hoary custom. The above-mentioned disadvantages are obviated readily by placing the teacher's desk diagonally in the left front of the classroom, causing the teacher to face in a direction opposite light sources when seated, at the same time permitting supervision of the seated pupils.

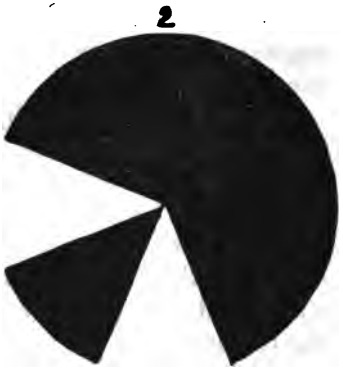
The accompanying chart (5) is a graphic representation of the direction of classroom illumination and the relative proportion of 109 classrooms lighted from one, two, or more directions. The periphery of the dark sphere here shown represents 109 classrooms to be illuminated, and the light segment the proportion of classrooms receiving light from a particular direction. It will be seen from this chart that the greatest number of these classrooms were lighted by windows placed to the left. The next greatest number by windows to the left and rear, 18.8 per cent and 27.2 per cent of the total number respectively. In other words, daylight was admitted to classrooms from a desirable direction in only 46.2 per cent of the rural classrooms of this county.

Of the classrooms in which windows were improperly located with respect to the desk arrangement, 20.5 per cent had cross illumination from right to left, 5.8 per cent right and rear, 21.2 per cent, left, right, and rear, and practically 3 per cent had windows on all four sides. In one school the light was received from the rear; in one from the front and left, and in two schools it was from the front, right, and rear. In nearly all these schools with faulty window arrangement, it would be practicable to close certain windows, enlarge others, and to modify the desk arrangement in a manner to secure better and more comfortable light at moderate expense.

DIFFUSION OF LIGHT AND AVOIDANCE OF GLARE.

The daylight illumination of classrooms is often defective because due measures have not been taken to secure the maximum diffusion of light entering such rooms. The diffusion of light depends upon the fact that all materials reflect light and under varying conditions scatter it in a greater or less degree. Some materials reflect nearly all the light diffusely, others specularly after the manner of a mirror. The ratio of diffusion to specularly reflected light by objects varies greatly according to the degree of surface polish and color.

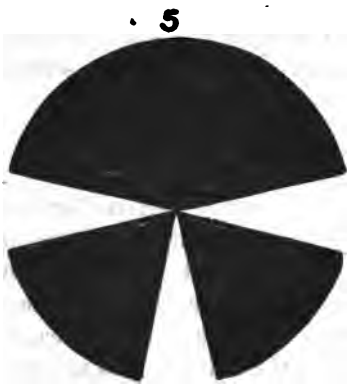
LEFT SIDED ILLUMINATION.



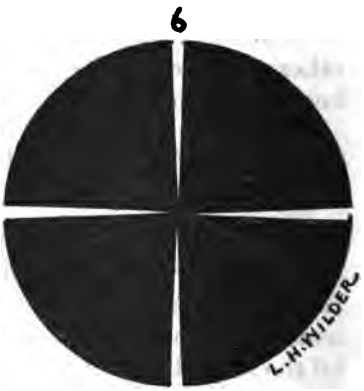
LEFT SIDED AND REAR ILLUMINATION.

LEFT AND RIGHT SIDED ILLUMINATION.

REAR AND RIGHT SIDED ILLUMINATION.



LEFT AND RIGHT SIDED AND REAR ILLUMINATION.



LEFT AND RIGHT SIDED, FRONT AND REAR ILLUMINATION.

U.S. PUBLIC HEALTH SERVICE

CHART 5.—Relative position of windows in Porter County classrooms. (Explanation of chart in text, page 41.)

Types of diffusion.—The measures necessary to secure the proper diffusion of light will be better understood in connection with a clear conception of what is meant by types of diffusion. The following definitions are taken from the report of a committee of the Illuminating Engineering Society on the "Optical Properties of Diffusing Media:"[1]

1. Specular reflection is that exhibited on a plain, polished surface, neither scratched, dirty, wavy, nor, if not opaque, reflecting diffusely within the surface.

2. Partly specular diffusion is the reflection of light in which a distinct image of the source may be seen, as by a dusty mirror, or sheet of glass overlying paper.

3. Near diffuse reflection is when the specular image is completely broken up, yet the diffusion is far from complete. Reflection from calendared paper and other wavy surfaces is of this class.

4. Diffuse reflection is when a surface is uniformly illuminated and appears equally bright, viewed at all angles of reflection. Blotting paper, felt, snow and other masses of fine crystals exhibit nearly perfect diffuse reflection.

This latter is the desirable type of light reflection in interiors. The more completely light is diffused the greater will be the avoidance of glare.

Glare.—Glare, as ordinarily defined, is a condition of reflection arising when the brightness of an object reflected peripherally on the retina is relatively greater than that of the object whose image is centered on the yellow spot.

In the report of the Illuminating Engineering Society on "Diffuse Media—Interior Furnishings,"[1] glare has been classified, as involved in interiors, into—

(1) *Brightness glare.*—Excessive brightness, such as occurs with the sun shining directly on snow, white paper, or a white window shade.

(2) *Contrast glare.*—Contiguous bright and dark objects cause disturbance of vision if their relative brightness is excessive. A bright illuminant viewed against its background, a dark window frame against sky or landscape, and glare exhibited on a glossy surface are familiar examples.

(3). *Veiling glare.*—That condition in which the surface to be observed appears covered with a light or dark veil of different or imperceptible pattern. A blackboard viewed from near the specular angle, when imperfectly located with respect to windows, often furnishes this type of glare.

Glare is observed when light rays are nearly parallel to the eye level. Therefore, light sources situated above this level are more likely to be free from glare. For this reason the lower edge of the classroom windows should be well above the visual level of the seated pupils.[2]

[1] Transactions of the Illuminating Engineering Society, July 20, 1915.

[2] The Boston school code requires the lower window sill to be 2½ feet from the floor, a distance not considered high enough from the standpoint of illumination. This distance is fixed by other authorities at 3.75 feet to 4 feet.

Furthermore, the more diffusely light is reflected and the lower the ratio of specular reflection thereto, the greater is the freedom from glare. Certain polished surfaces, largely influenced by their color, reflect light in a specular manner. The side walls of a schoolroom, therefore, should have a mat surface free from gloss. In the case of ceilings, however, no such objection exists, because the light reflected therefrom is at the greatest possible angle to the visual level, and therefore not likely to produce glare.

Classroom walls should also be colored in a manner to obtain reflection with a maximum of diffusion. For this reason shades of the primary colors, yellow and green, found near the center of the luminous portion of the solar spectrum, are selected because they not only have a high reflection coefficient, but possibly absorb other rays of the spectrum not concerned in illumination which may be injurious to sight.[1]

The use of a white coloring for the side walls of schoolrooms is objectionable because of glare, although the reflection coefficient is high. Its employment for ceilings, however, is admissible because the angle of reflection therefrom is nearly perpendicular to the visual level in classrooms of ordinary dimensions.

In 46 classrooms both the walls and the ceilings were painted green. Unfortunately the shade of green selected in many instances was so dark as to appear almost black, so that the light absorption thereof markedly diminished the illumination of said classrooms.

In 20 classrooms the walls and ceilings were both white. This is undesirable because of the eye discomfort induced by the high reflection coefficient of these surfaces at a level parallel to the eye.

In three classrooms both walls and ceilings were painted blue, and in three other instances were painted pink.

Some interesting combinations of color from the standpoint of undesirability were found in 13 classrooms. The most striking of these were green walls with natural wood ceilings in three instances; green and blue in two others; white and blue in one, and green and pink in one instance. These combinations are not pleasing to the

[1] The following table of coefficients of reflection is given by Harrison and Anderson (Transactions of the Illuminating Engineering Society, Sept. 23, 1915):

Ceiling.		Walls.		Floors.	
Color.	Per cent.	Color.	Per cent.	Color.	Per cent.
White	81.0	White	81.0	White	84.0
Light gray	64.0	Medium	42.5	Natural wood	14.0
Dark gray	33.0	Black	4.3	Black	7.6
Black	4.3				

eye, and a number of the ceilings have a very low reflection coefficient instead of a high one.

Wainscoting of wood was found in 50 classrooms. In eight others the lower part of the wall was painted a darker shade to a height ranging from 48 to 54 inches. The average height of wainscoting in all the schools of the county was 38.5 inches, ranging from 31 to 60 inches.

The ceilings of classrooms were of metal in 16 instances, wood in 5, and were papered in 2 schools. The side walls were papered in 4 schools. For sanitary reasons schoolroom walls should not be papered.

In 39 classrooms the wall and ceiling surfaces were gloss, mat in 61, and a combination of mat walls with gloss ceilings in 8 others.

In view of the definite value of proper illumination as an aid to the educator, the data relative thereto collected during this survey clearly emphasizes the need of scientific advice in planning the natural illumination facilities of schools. The average builder can not be relied on to plan buildings for educational purposes. In a matter apparently so small as the finish and coloring of classroom walls, this survey shows the need of due consideration of the principles of illumination rather than deference to the individual liking of school trustees or other influential persons. The cost of redecorating every classroom in the county where the color and finish were found objectionable would be small in comparison to the increased attractiveness and illumination efficiency.

REGULATION OF INTENSITY OF CLASSROOM ILLUMINATION.

It has been shown in another place in this report (see p. 22) that the orientation of school buildings is largely influenced by the desire to admit sunlight to all classrooms during some hour of the day. Direct sunlight shining on bright paper, books, and the like, however, will cause brightness glare. This may be avoided by the use of translucent window shades backed by another shade which is opaque to shut out direct sunlight. Window fixtures should be of a type to permit the adjustment of window shades from either the top or bottom of the window.

HEATING OF CLASSROOMS.

Under modern conditions the problems of heating and ventilation are so closely associated that either question can scarcely be considered separately in the planning and erection of school buildings. This is due to the necessity of warming fresh air introduced into classrooms in cold weather to replace that removed in the course of ventilation.

The physical laws which govern heat demand careful observance in the planning of buildings and form problems which require the assistance of skilled engineers whenever large installations are to be made. School trustees and principals, however, should acquire a certain familiarity with the general principles involved, to enable them to appreciate the necessity of expenditures for this purpose and to act intelligently.

EFFICIENCY OF DIFFERENT TYPES OF HEATING APPARATUS.

Grates.—It has been said that the best form of open grate gives only 20 per cent of the heating value of fuel. The intensity of heat from a grate varies inversely as the square of the distance from the source. Furthermore, the air of a classroom is not warmed directly by radiated heat, which passes through it without raising its temperature. For this reason an open fire warms surfaces of the body directly exposed to radiation only, while the rest of the body remains cold. An open fire acts, however, as an effective means of ventilation in rooms of reasonable size. It also causes a minimum reduction in the relative humidity of the confined air. Open fires may be appropriately utilized for heating classrooms in small mining towns and other localities where the fuel supply is plentiful and cheap.

Stoves.—From an economic standpoint the closed stove is the most effective method of warming rooms. The modern base burner is said to utilize 70 to 80 per cent of the fuel value of coal. Stoves heat by direct radiation from their surfaces and by convection due to changes in the weight of air heated by contact. It is of interest to note in this connection that the radiation of heat by stoves, and by radiators as well, is not influenced by their form, but that this power is affected by the color and condition of the radiating surfaces. In this respect polished surfaces radiate less heat than rough ones, and surfaces painted with lampblack or similar material radiate greatly in excess of those that are not.

The objection to closed stoves is due to the space occupied by them, the dust and dirt occasioned by their care, the difficulty of regulating temperatures, and the harmful influences on atmospheric conditions in confined spaces.

Closed stoves were used for heating purposes in 31 instances, or in 41.1 per cent of the rural schools.

The use of these stoves is usually accompanied by wide fluctuations in classroom temperatures and variations in different parts of the classroom at the same time, which are incompatible with physical comfort and educational effort.

The average temperatures observed in 21 schools so heated was 68.5° F., ranging from 59° F. to 81° F. These extremes of tempera-

ture, even though temporary, emphasize the difficulty of maintaining an equable temperature with this type of heating apparatus.

The use of the closed stove, furthermore, is accompanied by great reduction in the relative humidity of the classroom atmosphere. No steps had been taken in any of these classrooms inspected to obviate this condition. Measures usually adopted for this purpose in connection with closed stoves are far from adequate; but their use has an educational effect and serves to impress the pupils with the hy-

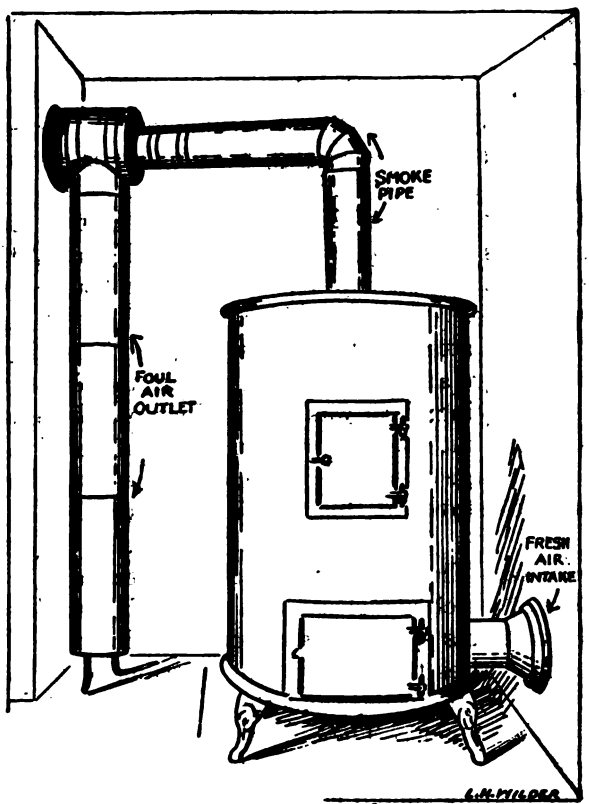


FIG. 7.—Type of jacketed stove.

gienic value of a requisite amount of moisture in the air of classrooms and homes.

Jacketed stoves.—An attempt to overcome the defects of heating by closed stoves, and at the same time retain their economic heating efficiency, is seen in the so-called jacketed stoves now in use in quite a number of rural schools, a type of which is shown in figure 7. The outside air is introduced directly to a space between the stove and a jacket surrounding it. The air expands on coming in contact with

the warm surface, rises, and carries heat to all parts of the classroom. The advantages of this method of heating are largely those of ventilation. These will receive further consideration under the proper caption (p. 54).

Jacketed stoves were installed in 26 instances or in 34.5 per cent of the rural schools of the county.

The care of jacketed stoves is more complicated than that of the ordinary closed type. The fresh-air connections were broken, disconnected, and otherwise rendered useless in a number of instances, so that the air supplied was drawn either from the building or cut off altogether. As a result the combined efficiency of the heating plant was reduced to that of the closed stove. Moreover, collections of dirt and other débris were found accumulated in the spaces surrounding the stove and its jacket and in a number of instances in the air supply pipes.

The average temperature of 22 schools heated in this manner was 74° F., the extremes being 65° F. and 85° F. All parts of the classrooms, however, were heated in a more uniform manner than with the closed stove type.

Humidifiers were attached to these stoves and were in use in 11 schools. The average amount of water evaporated from receptacles in 10 schools employing them was 1.25 gallons per diem, an amount so small as to make but little impression upon the relative humidity of the air in an average classroom. The humidifiers usually met with in connection with stoves of this type are too small and are badly located.

Hot-air furnace.—The hot-air furnace is essentially a stove the heating surface of which is inclosed in a case with a space separating the two. Through this space the air from outside sources circulates and when warmed rises to the points of distribution. The furnace is usually located in the cellar, and the heated air is conducted by flues to the various rooms. These heating flues are usually covered by a grating where they enter the classroom. The total area of the openings in the grating should equal that of the cross section of the conducting flue. The register, as the grating is called, should be fitted with a damper, by which the flow of heated air may be regulated.

The circulation of air takes place because of the difference in the weight of the heated air inside and of the air outside of the conducting flues. This difference in weight is small; consequently, in installations where the furnace or conducting flues are improperly located certain classrooms are insufficiently warmed during stormy weather, depending on the intensity and direction of the wind.

The efficiency of a hot-air furnace, when the air to be warmed is taken from the outside, is said to be 50 to 60 per cent of the heating value of the fuel.[1]

Temperatures in 15 classrooms, heated in this manner, were recorded, the average being 73.5° F., and the extremes 67° and 84° F., respectively.

Hot-air furnaces were installed in 16, or 21.1 per cent, of the schools of the county. The air used for purposes of warming was carried by gravity to the classrooms of 10 schools, or 62.5 per cent of those warmed by this system. In 6 other schools the hot air was introduced to the classroom with mechanical assistance.

Temperature observations were also made in 12 classrooms in 4 schools, where mechanical aids to hot-air conduction were employed. The average temperature of 12 classrooms was 72.5° F., the extremes being 70° and 79° F., respectively.

The humidification of the classroom atmosphere in all these schools was entirely inadequate.

Steam and hot-water heating.—In but two schools of the county, Kouts and Porter, were steam or hot-water systems used. The advantage of these systems lies in the ease and certainty with which heat may be conveyed from a central plant to distant points, practically uninfluenced by the force and direction of the wind.

From the standpoint of ventilation, however, direct heating by steam or hot water differs but little from the closed stove. The efficiency of direct steam or hot-water heating is said to be 60 to 70 per cent.

Direct hot-water heating has certain advantages over steam, due to the circulation of the former taking place at a lower temperature, namely, about 140° F. for hot water and 212° F. for steam. Hot-water plants, therefore, begin yielding heat much more quickly after starting the fire than is the case with steam and continue to do so for a longer period after the fire has died down. Furthermore, by reason of these characteristics of hot-water heating, a more uniform temperature may be maintained in rooms heated in this manner.

[1] Certain rules which give approximate results have been devised for the guidance of those unable to obtain expert advice with respect to hot-air installation (John R. Allen: Heating and Ventilation):

1. The volume of the house divided by 50 equals the square feet of heating surface in a furnace radiator.

2. The volume of the house divided by 20 equals the number of square inches of grate area in the furnace.

3. Divide the volume of the room by 20 and the square root of the quotient will be the diameter of the furnace pipe for the first-floor rooms. For the second-floor rooms, divide the volume by 25, and the square root of the quotient will be the diameter of the furnace pipe.

It must be emphasized that rules of this character give only approximate results. The necessity of some easily calculated standard to supersede the hit-or-miss installations so commonly found in these schools is apparent in many rural communities.

TEMPERATURE REGULATION IN CLASSROOMS.

Objection has been made to the maintenance of a uniform classroom temperature because, by so doing, certain stimuli habitual to ordinary everyday environment are removed; as, for example, the effects of variations in heat and cold on the blood pressure. This stimulation is doubtless of considerable value in certain general disorders, where education assumes a position of secondary importance. In the case of healthy children, however, the maintenance of a desirable uniform temperature in a healthful environment is unobjectionable from the standpoint of health and is most conducive to mental application, by removing the physical stimulation in question.

The temperature usually advocated for classrooms in this country varies from 68° to 70° F. This standard, however, may be modified by climatic conditions. For example, 60° to 65° F. is considered a desirable indoor temperature in England, where the climate is uniform and the air is of high relative humidity. Similar conditions are found in localities in this country, in which places the maintenance of classroom temperatures should be regulated accordingly. Variations in either direction from this standard cause physical discomfort incompatible with the best mental effort.

The maintenance of classroom temperatures above 70° F. is an economic loss through increased coal consumption. In schools in which no provision is made for heat control an unnecessary amount of fuel is consumed and heat is wasted through doors and windows opened for cooling purposes.

Temperature observations[1] in individual schools and classrooms are recorded in the following table:

TABLE I.—*Atmospheric conditions in 72 classrooms in the rural schools of Porter County, Ind.*

Township and school.	Temperature.	Carbon dioxide per 10,000.	Relative humidity.	Humidifier.	Water evaporated daily.
Boone:	°F.		Per cent.		Gallons.
Aylesworth				+	1
Bryant	77		0.44		
Frye	71	8	.53		
Hebron, 1	71		.44		
Grades 1–2, 2	72		.41		
Grades 3–4, 3	71		.69		
Grades 5–6, 4	72		.47		
Grades 7–8, 5	72		.47		
Tannehill	74		.35		
Center:					
Cooks Corners	74	[2]—6	.31		
Flint Lake	79	8.75	.18		
Leonard	77		.21		

[1] A number of temperature observations made in this survey were discarded because, the weather being mild, they represented outside atmospheric conditions rather than methods of heat regulation.

[2] —6=less than 6 quarts per 10,000.

TABLE I.—*Atmospheric conditions in 72 classrooms in the rural schools of Porter County, Ind.*—Continued.

Township and school.	Temperature.	Carbon dioxide per 10,000.	Relative humidity.	Humidifier.	Water evaporated daily.
Jackson:	° F.		Per cent.		Gallons.
Burdick	85	−6	0.21	+	.....
Carter	79	8.5	.32	+	1.5
Coburg	71	−6	.29	+	1.0
County line	65	7	.52	.....	.....
Jackson Center, 1	67	−6	.52	.....	.....
Grades 1–2	.....	.....	.....	.....	.....
Grades 7–8, 2	79	−6	.29	.....	.....
Quakerdom	66	−6	.39	+	.75
Liberty:					
Babcock	81	8	.42	.....	.....
Coles	70	8	.35	+	1
Crocker	81	10	.46	.....	.....
Liberty Center (H. S.), 1	70	−6	.38	.....	.....
Grade 2	71	−6	.33	.....	.....
Linderman	67	−6	.30	.....	.....
Phares	73	−6	.54	.....	.....
Salt Creek	71	8.15	.45	.....	.....
Morgan: Schroeder	61	−6	.32	.....	.....
Pine:					
Bayles	79	8	.30	.....	.....
Brick	75	9	.30	.....	.....
Carver	72	7.5	.36	.....	.....
Frame	70	10	.40	+	1
Smoky Row	70	10	.42	+	1
Pleasant:					
Kouts, H. S. (H. S.), 1	74	−6	.31	.....	.....
Grades 6–7, 2	.....	.....	.....	.....	.....
Grades 4–5, 3	70	−6	.44	.....	.....
Grades 2–3, 4	74	−6	.35	.....	.....
Grade 1, 5	78	−6	.39	.....	.....
Lauer	77	−6	.36	+	2
Morrison	70	7.5	.....	.....	.....
Stowell	88	−6	.24	+	1.5
Portage:					
Crisman (high)	71	5.2	.41	+	5
Grades 1–2	69	8	.52	+	5
Grades 3, 4–5	84	8.2	.35	+	5
Grades 6, 7–8	76	6.5	.42	+	5
Dombey	70	8	.36	+	.5
McCool	78	7.5	.46	.....	.....
Peak	67	7.5	.....	.....	.....
Wolf	68	.....	.....	.....	.....
Porter:					
Gates Corners	65	.59	.....	.....	.....
Hurlburt	56	.....	.....	.....	.....
Porters Cross Roads	67	.....	.48	.....	.....
Skinner	71	.....	.39	.....	.....
Union:					
Cherry Glenn	76	.....	.35	.....	.....
Foster	68	−6	.46	.....	.....
Peck	71	.....	.31	.....	.....
Union Center—					
Grades 1–4	72	8	.27	.....	.....
Grades 5–8	76	8.5	.30	.....	.....
Wheeler—					
Grades 1–2	67	−6	.40	+	1
Grades 3–5	78	−6	.27	+	1
Grades 6–8	69	−6	.41	+	1
High School	71	−6	.41	+	1
Washington:					
Blake	68	−6	.46	.....	.....
Bryerly	69	.....	.34	+	3
Luther	64	−6	.44	.....	.....
Washington Township—					
Grades 1–6	77	−6	.25	.....	.....
Grades 7–8	76	−6	.26	.....	.....
Westchester:					
Balleytown	71	8	.56	.....	.....
City West	63	7.5	.40	.....	.....
Furnessville	75	8.75	.35	.....	.....
Mosquitotown	59	−6	.53	.....	.....
Old Porter	76	9	.27	.....	.....
Salt Creek	64	.....	.38	.....	.....
Waverly	67	9.15	.41	+	[1] 1.75
Average	72	.....	.363	15	1.4

[1] Quarts.

The widest variations in classroom temperatures were observed in schools heated by closed stoves, the average being 68° F. and the highest 81° F. Furthermore, the temperature varied in different parts of these classrooms, according to the distance from the stove.

Considerable variations of classroom temperatures were observed in all cases where heating was by jacketed stoves and hot-air furnaces located in basements. The average temperature in the former was 74° F. and in the latter 73.5° F., the highest being 85° F. and 84° F., respectively. The warming of all parts of these classrooms was more uniform than by either of the other methods discussed. These observations, however, plainly indicate the maintenance of too high classroom temperatures at times and undue fuel consumption. These faults are due, in part, to the type of heating system installed and in part to careless supervision.

Variations in the temperature in the classrooms warmed by hot air, mechanically assisted, were unnecessarily great. This was usually due to the absence of automatic temperature regulators.

Measures.—The efficiency of regulating temperatures where the closed stove is used depends largely on the care and attention given by some competent person, the size of the stove in relation to the cubic capacity of the classroom, the fuel used, and the material used in the building construction and its state of repair. The use of closed stoves in one-room rural schools, though economic from the standpoint of fuel consumption, is being rapidly abandoned because of the difficulty experienced in securing constant temperatures and the harmful influence of the stoves from the standpoint of ventilation.

The regulation of temperature in the case of hot-air furnaces supplying heat by gravity is accomplished by the proper adjustment of dampers in supply pipes and furnaces, and through due attention to the installation of conducting flues in inside walls protected, so far as possible, from outside atmospheric influences. Furthermore, the size of the furnace in use contributes largely to the uniformity of classroom temperatures. A furnace which has to be fired until it becomes red-hot to secure a desirable classroom temperature is too small for the building.

Steam, hot water, and mechanically assisted hot-air heating systems readily lend themselves to the use of automatic devices for securing constant classroom temperatures. The essential feature of an automatic heat regulator consists of a thermostat so constructed that its parts will move with a change of temperature in the surrounding air and furnish power to operate the air valves or electric contrivances which cause the opening and closing of valves or dampers of the heating system involved. The great advantage of

an automatic temperature control device, aside from securing a constant classroom temperature, is that the heating of classrooms is removed from the control of teachers and therefore uninfluenced by personal bias or judgment. The expense of temperature regulating installations, though considerable, is more than counterbalanced by the saving in fuel consumption incident to a regulated classroom temperature.

Electrothermic indicators are of value for the regulation of classroom temperatures in schools where full-time janitors are employed. By means of this indicator the janitor can instantly determine the temperature in any classroom from a point near the furnace and thereby determine defects or disarrangement of the automatic heat-regulating system which require attention.

The jacketed stove remains the best solution of classroom heating in the one-room rural schools. The system of hot-air heating by a centrally-located furnace in the basement is particularly adapted to local conditions in isolated rural schools of more than one room. Heating by hot water and steam requires greater care and attention between the closing and opening hours of school than is usually available for schools so situated. Where gravity is relied on to carry the air, the use of a hot-air system of heating is limited to the classrooms of schools compactly built and covering comparatively small ground areas; otherwise the inclination of certain conducting flues will be so great that the forces of gravity inducing air currents will be nearly equalized.

VENTILATION.

GENERAL CONSIDERATIONS.

The injurious effects of more or less prolonged exposure to conditions of imperfect ventilation in restricted spaces such as assembly halls and classrooms are well recognized. The exact manner in which these influences operate to cause injury, however, is not easily explained and concerning it there exists considerable difference of opinion.

Recent investigations tend to show, however, that the injurious results of confined air in crowded places are due to certain physical changes, involving temperature, humidity, and movement of the air in these confined spaces, which operate to create disturbances of the heat regulation of the body and cause variations in the blood pressure. The manner in which these disturbances affect health is not thoroughly understood at present.

It matters not whether one accepts the theory that confined air spaces vitiated through human occupancy contain some harmful

substances which require removal or the contention that the sole necessity, from the standpoint of ventilation, is to keep the air cool and in motion, the fact remains that the requirements demanded of a satisfactory system of ventilation are an abundance of outside air, not unduly heated, properly moistened, and free from mechanical impurities; in other words, a supply of air approximating natural conditions as closely as possible.

Changes of air.—Although the discomfort induced by a "close" atmosphere may be dispelled by setting the air in motion, and under certain restrictions a confined atmosphere can be rebreathed without appreciable harmful effect, after being washed and deodorized, nevertheless, for the purposes of practical ventilation, the necessity remains to supply a definite volume of air to densely populated classrooms.

Supply of air necessary for classroom purposes.—The calculation of the requisite volume of air necessary to supply a classroom under given conditions for practical purposes is based on certain compositional differences between air before and after respiration, represented by the amount of carbon dioxide present.

For the want of more precise knowledge of the influences of the volume of the air in ventilation, an arbitrary standard has been adopted which requires fresh air to be supplied in volume sufficient to keep the amount of carbon dioxide down to not more than 6 parts in 10,000.

The accepted requirement heretofore has been that each pupil should receive 30 cubic feet of air per minute, or 1,800 cubic feet per hour. The number of air changes per hour necessary to supply this amount depends on the cubic capacity of the classroom and the number of pupils. The cubic space allotted each child should be large enough to demand not more than six changes of air per hour in order to avoid objectionable drafts. The Indiana law provides 225 cubic feet of space for each child, the floor space in each case being 20 square feet.

Carbon dioxide was present in seven classrooms to the extent of 8 parts in 10,000 and in four classrooms to the extent of 10 parts in 10,000. In other words, fresh air was admitted to a large number of rural classrooms in deficient amounts, as represented by these figures. The number of carbon dioxide determinations was limited, due to several causes, principally the advent of warmer weather, followed by more open windows.

Methods of securing requisite air allowance.—There are two general methods of ventilation: namely, the gravity system, or so-called natural ventilation, and mechanical ventilation, with the use of fans. In addition to these two general ventilating systems, window

ventilation, jacketed stoves, perflation, window sash openings, flues in the ceiling leading to louvered outlets and other forms of ventilators in the roof, perforated bricks, or other openings are aids to ventilation which may be employed in small one-room schools. With respect to the relative advantages of these various systems, those that ventilate by means of open windows and other similar devices are more healthful. Mechanical ventilation presupposes closed windows, a disadvantage from the standpoint of hygiene. The advantages of this system of ventilation, however, are due to the ability to deliver air in definite quantities at a given rate to a particular place, to take it from a selected source, to warm it to the desired temperature, to wash and free it from mechanical impurities, and to add a desired percentage of moisture.

Mechanical ventilation.—In all systems of mechanical ventilation due attention must be given to the installation of conducting air flues, their size, the friction and velocity of air currents—matters of technical detail requiring the attention of skilled engineers. In general, the size of the conducting pipe should be calculated to supply not less than 1,800 cubic feet of air per pupil per hour, or six changes per hour, as the case may be, with a velocity of the air current at the register of not more than 300 feet per minute. In the case of very large registers, so located that the air current will not strike the pupils directly, a velocity as great as 500 feet per minute is said by ventilation engineers to be permissible.

Rate of air exchange.—In Table 2 is shown the rate of air exchange in 33 classrooms of Porter County, as determined by actual measurements with an anemometer:

TABLE II.—*Rate of air exchange in 33 classrooms of the rural schools of Porter County, Ind.*

Township.	School.	Total.		Per pupil.		Per desk.	
		Inlet per second.	Outlet per second.	Inlet per second.	Outlet per second.	Inlet per second.	Outlet per second.
		Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Boone	Hebron:						
	High School	32.45	34.80	0.53	0.57	0.44	0.48
	Grades 1–2	17.98	34.65	.45	.87	.48	.92
	Grades 3–4	22.80	12.40	.69	.38	.54	.30
	Grades 5–6	19.72	19.52	.73	.72	.65	.65
	Grades 7–8	36.26	23.78	1.81	1.19	1.44	.88
Center	Leonard	15.30		1.02		.61	
Jackson	Carter		3.50		.18		.14
	County Line	1.73	1.92	.10	.11	.09	.10
	Jackson Center:						
	Grades 1–2	30.60	26.35	1.50	1.32	1.50	1.32
	Grades 7–8	34.00	24.15	2.62	1.86	1.10	.76
Liberty	Crocker	4.50	.96	.19	.04	.18	.08
	Daley	4.62		.26		.11	
	Liberty Center:						
	High School	25.20	25.20	1.15	1.15	.84	.84
	Grades	22.80	3.90	1.14	1.20	.95	.16
Pine	Smoky Row		1.32		.06		.06

TABLE II.—*Rate of air exchange in 33 classrooms of the rural schools of Porter County, Ind.*—Continued.

Township.	School.	Total.		Per pupil.		Per desk.	
		Inlet per second.	Outlet per second.	Inlet per second.	Outlet per second.	Inlet per second.	Outlet per second.
		Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Pleasant	Kouts:						
	High School	15.60	17.16	0.30	0.33	0.26	0.29
	Grades 6-7	8.28	15.60	.30	.56	.19	.36
	Grades 4-5	14.30	16.90	.41	.48	.29	.34
	Grades 2-3	19.15	.....	.58	.....	.42	.....
	Grade 1	.....	4.68	.....	.15	.....	.11
Portage	Crisman:						
	High School	18.85	10.80	1.57	.90	1.26	.72
	Grades 1-2	31.62	12.60	1.51	.60	.81	.32
	Grades 3-5	21.70	8.82	.59	.24	.53	.22
	Grades 6-8	30.07	2.16	1.16	.08	.97	.07
	Dombey	.....	15.40	.....	.70	.....	.53
	McCool	.....	2.03	.....	.10	.....	.05
	Wolf	3.40	1.82	.28	.15	.09	.05
Union	Wheeler:						
	Grades 1-2	8.25	5.85	.52	.37	.24	.17
	Grades 3-4	11.60	8.64	.31	.23	.28	.21
	Grades 7-8	11.20	1.60	.32	.05	.32	.05
	High School	9.75	4.50	.49	.23	.33	.16
Washington	Bryarly	19.78	3.60	1.80	.33	.79	.14
Westchester	Furnessville	.....	.62	.....	.05	.....	.02

The number of these observations was restricted owing to the early advent of spring and the discontinuance of fires. It will be seen, however, that the requisite number of cubic feet per minute is supplied in the Hebron, Jackson, and Liberty Center schools, where the Plenum system is in use. In other cases, where the systems depended on gravity, the amount of air supplied per minute for each pupil was largely deficient, if measured by accepted standards. It varied from more than the necessary amount in some classrooms of the larger schools to hardly any exchange in others, depending on the direction and force of the wind.

Air space per pupil.—The smaller the cubic allotment per pupil, the greater will be the required number of air changes to secure due allowance of fresh air per hour. The space for each pupil should, therefore, never be less than 250 cubic feet with a floor space allowance of about 20 square feet.

The air space and floor area per pupil in actual attendance at Porter County schools was greatly in excess of the usual requirements, being 443 cubic feet and 36 square feet, respectively. Calculations were also made on the basis of the number of desks observed in each classroom. According to this measurement the average air space and floor space for each desk were 285 cubic feet and 23 square feet, respectively.[1] In other words, even with a full attendance, ample provision of air space was made in practically all of the schools of the county.

[1] The average number of pupils per classroom was 23.36 and the number of desks 33.5.

Inlets and outlets.—The actual and relative location of inlets and outlets in classrooms is important. Air circulated in a classroom rises to the ceiling, is cooled by coming in contact with the cold walls and windows, and falls to the floor. Inlets, therefore, should be on the inner wall of the classroom, so that the current of fresh air entering is directed toward the outer wall. The location of the inlet should be high enough to be well above the breathing level of the pupils—usually about 8 feet above the floor. The outlet should be on the same side of the room as the inlet; it should be high enough from the floor to avoid accumulations of dust and dirt. The size of the inlets and outlets is also of importance and can be calculated either with respect to the cubic capacity of the classroom or the number of pupils to be supplied with fresh air at a given velocity at the register. Tables for this purpose are to be found in works on ventilation.

The minimum size of inlets and outlets given by various observers, on an empirical basis, varies from 2½ to 24 square inches for each pupil. Certainly an area of 2½ square inches would call for air delivered at very high velocities, which is undesirable from the standpoint of both comfort and economy. When practicable, the outlet should be larger than the inlet.

Of 63 classrooms noted, 43, or 68 per cent, were provided with inlets of too small area. In no instance was the area of the extracting flue used in connection with jacketed stoves (similar to the one shown in fig. 7, p. 47) great enough to make much impression on atmospheric conditions in the classrooms. No mechanical ventilating devices were found in use in any of the schools of the county heated by stoves.

The ventilation of 27.6 per cent of the classrooms of the county depended entirely upon the natural circulation of the air through the walls, window openings, and crevices of various kinds. The Plenum System of ventilation was employed in ventilating 20.8 per cent of the classrooms and the gravity system, which included the use of jacketed stoves, in 51.6 per cent.

HUMIDITY.

The humidity of the surrounding air assists in the maintenance of uniform bodily temperature and, in desirable amounts, operates to promote bodily comfort, to increase resistance to disease, and to reduce fuel consumption.

A dry classroom atmosphere is harmful to the respiratory apparatus, because of the absorption of moisture of the respiratory mucous membrane, causing dryness and fissures through which the infectious agents of respiratory diseases may gain entry.

The effect of high humidities in a warm atmosphere, on the other hand, tends to cause heat stagnation and a disturbance of heat elimination from the body, inducing the well-known feeling of discomfort experienced on humid summer days.

Desirable classroom humidities.—The question of the most desirable humidity for classroom purposes is not fully determined. Certainly a very high humidity in cold weather is liable to cause undesirable condensation of moisture on windows and outside walls. It is agreed quite universally, however, that, depending on the outside temperature, a relative humidity below 35 per cent is injurious, 50 per cent is desirable, and 70 per cent at 70° F. causes no harm.

The greater number of classrooms had a relative humidity of less than 40 per cent. Furthermore, 41.7 per cent of these classrooms had a relative humidity of 35 per cent or less, largely due to failure to provide and utilize measures intended to obviate this condition. Humidity determinations were made by the use of a sling psychrometer.

Measures for regulating humidity.—Cold air contains less moisture proportionately than warmed air. During cold weather it becomes necessary, therefore, to add moisture to heated air used for ventilating purposes. For example, to supply a classroom of 35 pupils with 1,800 cubic feet of air each per hour at 70° F., with a relative humidity of 70 per cent for seven hours, would require the evaporation of over 30 gallons of water, when outside air is taken at a temperature of 30° F., with a relative humidity of 70 per cent. The futility of pans on stoves and radiators for the purpose of securing the necessary humidification of classroom atmospheres is evident. In fact, as mentioned in the section on heating, the humidifiers connected with the usual jacketed stoves were too small to supply anywhere near the desired amount of moisture. They were located badly in most instances, being low down near the firebox, so that the air passed over them before being heated instead of afterwards, as should be the case.

Use of humidostat.—One of the great advantages of mechanical ventilation is that it lends itself readily to the maintenance of a desirable relative humidity, which may be regulated by the humidostat. This apparatus is arranged to act automatically. When the humidity in the surrounding air decreases it opens steam or water jets necessary to supply moisture to the incoming air and closes them when the required humidity is obtained.

Air washing.—It has been found practicable by a system of air washing for the purpose of abstracting mechanical impurities also to supply necessary moisture, an excess of which can be abstracted in chambers arranged for that purpose. These measures are impracticable in small rural schools. It has been shown by actual experi-

ment, however, that indoor humidity may be maintained as well by a judicious routine opening of windows as with the use of mechanical devices.

In large and consolidated schools, air washing may be economically practiced, thus permitting the recirculation of inside air, heated by the so-called rotation method. This reduces coal consumption by obviating the necessity of taking colder outside air and heating it to the required temperature. The effect of recirculated air on health, however, has not been definitely determined.

As stated in the section of this report devoted to heating (p. 48), no adequate attempts were made in any of the rural schools of the county to secure proper classroom humidities.

DUST.

Dust and other impurities.—Evidence has accumulated to show that there is less dust and bacteria in mechanically ventilated classrooms than in those which are unventilated. As many as 256 bacteria per cubic foot have been found by one observer in unventilated rooms, as compared to practically none in ventilated rooms.

The effect of breathing dusty air is largely mechanical and results in excoriations and irritation of the mucous membrane that cause it to be receptive to the entry and lodgment of disease-producing organisms.

Aerial infection with bacteria is possible only at very short distances, and is largely due to the expulsion of infected particles by those harboring the germs of disease during sneezing and coughing. These suspended particles soon settle, however, and the majority of them become innocuous through drying. Nevertheless, the causative agents of tuberculosis and pneumonia, when protected from oxidation by an albuminous coating derived from the secretions, may withstand drying for a long period and must, therefore, be removed by ventilating methods.

Measures for eliminating dust.—Air-washing stands at the head of the list of methods for removing the dusts from air used for ventilation. This method has been found more effective than the former practice of straining the outside air through burlap or some similar material. The use of devices of this character is restricted to large schools which have competent supervision, and is therefore not applicable to the rural schools of Porter County; but certain precautions may be taken to minimize the dust nuisance, of which the following are important:

(1) *Fresh-air intakes.*—The location of fresh-air intakes has a definite bearing upon the amount of dust admitted to classrooms. In general, the fresh-air intake should be located on the warm side

of the school building—preferably the south. It is undesirable to locate the fresh-air intake close to the roof because of the danger of drawing smoke into the classroom. The intake should be of ample proportions to furnish an abundant supply of air, should be screened and elevated to a point well above the ground level. To exclude cellar air and the gases of combustion, all connections leading to the furnace should be tight. In all cases the fresh-air intakes should be screened to shut out coarse material which otherwise might plug the ventilating ducts.

In no instance was the cold-air intakes of the schools of the county elevated more than 3 feet. A few of them were even below the ground level; others were so situated and connected as to act as improvised vacuum cleaners for basements and spaces beneath the floors between the foundation walls.

(2) *Chalk troughs.*—The use of troughs for the collection of powdered chalk and the avoidance of blackboard dust has been discussed in connection with classroom equipment (p. 34).

(3) *Door mats.*—In rural districts mud carried into the classroom on the children's feet is largely responsible for dust and dirt accumulations. Provision should be made for the purpose and children required to clean their boots and shoes before entering school.

(4) *Sweeping.*—The frequency with which sweeping is done and the time and method of sweeping are of importance for controlling and preventing the accumulation of dust in classrooms. Sweeping should preferably be done after school hours; if before school, at least not later than one hour before the assembling of the pupils.

In country schools during muddy weather, sweeping is necessary at more frequent intervals than once daily, in which case it should be done as long as possible before the assembling of classes in order that sufficient time may elapse for the settling of dust. Moist sawdust and sweeping compounds might be used to advantage in places where vacuum cleaners are not available.

(5) *Dusting.*—Schoolroom furniture requires careful attention to dusting. This procedure should follow sweeping regularly as soon as the dust has settled. In places where the sweeping is done after school hours, dusting could well be deferred until the following morning. A moist cloth should be used for this purpose, or preferably a paraffin cloth or one moistened with kerosene.

CLASSROOM CLEANING IN PORTER COUNTY SCHOOLS.

Observations were made with respect to the janitor's service in a number of classrooms in the course of this survey. It was found that sweeping was done daily in 80 per cent of the schools, twice a week in 12 per cent, and three times a week in 8 per cent. Sweeping was done twice daily in 3 of the schools of the county.

Dry sweeping was practiced in 80 per cent of the rural schools, and the use of moist sawdust or sweeping compounds in the remaining 20 per cent.

The time of sweeping was after school hours in 82.5 per cent of the schools, before school in 12 per cent, and at the noon hour in 4 schools.

Dusting was done in but 71 per cent of all the schools. Moist cloths were used for dusting purposes in 39 schools, dry cloths in 16, and a cloth which had been oiled in 2.

The floors in 87 per cent of all the schools of the county had been oiled once during the year. The use of oil on floors for the elimination of dust in classrooms is free from the danger of fire, provided the oil used for this purpose has a flash point not under 150°.

ELIMINATION OF ODORS FROM CLASSROOMS.

The presence of odors in rural one-room schools is especially noticeable, due to rural conditions and rural occupations which occasion greater or less intimacy of contact with the stable, horses, and other domestic animals. The elimination of odors can be accomplished by the admission of ozone in due amounts to classrooms. It must be remembered, however, that an amount of ozone in the atmosphere in excess of 10 parts per million is incompatible with comfortable respiration and causes irritation of the eyes, nose, and throat.

The use of ozonizers is impractical in these schools; but this can be compensated for by routine opening of windows and other ventilating devices.

OTHER MEASURES FOR SECURING OUTSIDE AIR CONDITIONS FOR SCHOOLS.

In recent years the use of muslin screens in the place of the lower sashes and panes of glass is classroom windows has been advocated. This device is said to bring about classroom atmospheric conditions, comparable to outside air, that more than compensate for any additional coal consumption occasioned by their use. Among the disadvantages of this device may be mentioned the reduction of classroom illumination in certain localities by the accumulations of soot and dust on the screens. The suggestion, however, is worthy of further trial in selected rural communities where the surrounding air is comparatively free from mechanical impurities.

Cold rooms.—The maintenance of a classroom temperature of 55° to 60° F. has been advocated in the case of children with latent noncommunicable infections, anemic children, those with enlarged tonsils and adenoids, mouth breathers, and children who take cold easily and are subjected to headaches from constitutional causes. Cold classrooms are also advocated for children who fail to make grade, especially when this is due to poor physical condition.

Cold classrooms, however, are not desirable or demanded for normal children from an educational standpoint. Their use in rural communities for the purposes outlined is necessarily restricted to consolidated schools with attendance large enough to warrant this arrangement.

Open-air schools.—No study of atmospheric conditions in connection with school life would be complete without some mention of open-air schools.

In certain chronic affections advantage is taken of the restorative action of open-air conditions upon health to combine it with education by the use of open-air schools. Schools of this character are especially desirable for children suffering from clinical tuberculosis and subnormal children received from a tubercular environment.

CLOAKROOM ACCOMMODATIONS IN RURAL SCHOOLS.

Probably no single feature of rural school construction has received so scant attention as the provision of appropriate conveniences for the care of wraps and other articles of extra clothing of school children. Frequently in the schools surveyed no cloakroom accommodations whatever were observed, the classroom walls being utilized for this purpose. In other instances the cloakrooms were mere makeshifts, too small for the purposes intended, and also used as a storage place for discarded school furniture and other equipment.

The need of suitable cloakroom accommodations is especially apparent in country districts, where children often travel considerable distances and are exposed for long periods to inclement weather conditions. The cloakrooms of country schools should, therefore, afford ample space for drying wraps. Furthermore, country school children necessarily wear much clothing. As this excess must be taken care of, the cloakrooms in country schools should be proportionately larger than in urban communities.

The use of halls and walls of classrooms for wraps is objectionable because of the untidy appearance. When installed in halls, racks are decided obstacles in the case of fire and a distinct menace to life.

The most suitable location for the cloakroom in schools is yet a mooted point. There seems to be no very sound reason why cloakrooms should open into the classroom, as advocated by some authorities. Furthermore, there is but little to commend the practice advocated of ventilating the classroom through the cloakroom by an outlet placed in the lower part of the communicating door.

In general, the cloakroom should be easily accessible, with an outside exposure to insure the admission of sunlight and window ventilation. It is desirable that cloakrooms should be separately ventilated, so that, when the ventilating system is out of order, the odors will not pass into the classroom.

The width usually advised for cloakrooms is about 4 feet, with 50 linear feet of wall space for each 25 pupils. Suitable pegs or hooks should be provided and located on the wall at various levels for the accommodation of children of different heights. Racks or frames for drying moist clothing are desirable.

The installation of individual keyless lockers, though not at all essential, is an advantage. Lockers of this type are usually of metal, and each locker should be ventilated.

Separate cloakrooms were provided in 38 per cent of the schools inspected. Halls and entrance vestibules were used for cloakroom purposes in 34 per cent, and the classroom walls in slightly more than 25 per cent. In addition, in two schools, a classroom alcove was used for cloakroom purposes and in one school the hall was used in addition to cloakrooms.

In numerous instances the cloakrooms inspected were inadequate in size, without heat, and presented a neglected appearance.

JANITOR SERVICE.

Many of the undesirable aspects of rural school hygiene could be directly improved by an efficient janitor service. In large schools where janitors are employed, certain definite rules should be made with respect to the hours for making fires, the sweeping of classroom floors, the dusting of classroom furniture, the removal of powdered chalk accumulations, and the routine airing of classrooms after school hours. Owing to the ever-present danger of fire, janitors should be required to remain on the school premises during the hours of school to be of assistance in an emergency of this nature.

Paid janitors were employed in 6 schools of the county. Janitor's work was performed by the teacher in 58 schools, by the teacher and pupils in 4 schools, by the teacher and help paid by herself in 5 schools, and by the pupils in 2 schools.

PART II.

PHYSICAL FITNESS OF RURAL SCHOOL CHILDREN IN PORTER COUNTY.

INTRODUCTORY OBSERVATIONS.

It is now known that the rate of growth of the human body varies in a definite manner. The highest rate is attained during the earlier months of embryonic life, from which point it declines until about three or four years before puberty. The rate is accelerated during adolescence and declines rapidly after mature establishment of the reproductive functions. Physiological development, however, presents wide individual variations from the normal.

Definite knowledge of the physical development of the children of a county or community is of great value in determining the existence of unhealthful influences. The well-known hampering effect on growth of hookworm, chronic malaria, and conditions which induce nutritional diseases is reflected to a great degree over wide areas of this country by the stature and rate of growth at different age periods of the children of communities so affected.

The legal limitation of the age at which children may enter certain occupations is becoming definitely fixed in an increasing number of States. But the intent of these laws will be largely defeated unless child labor be restricted to certain occupations according to the physical development of a child at a given age period.

The educator is vitally interested in the physical development and perfection of the school child. It enables him to adapt mental instruction to physical imperfections in individual cases.

Because of the wide variations in climate, the influences of immigration still operating, and the extremes in density of population, no uniform standard of physical growth would seem possible in this country as a whole. The population is not homogeneous racially, and until racial amalgamation shall have been completed the necessity of determining the mean physical development of children in different sections of the country will remain.

The physical averages of children determined in the past have been based largely on an examination of nonrepresentative groups in hospitals, orphanages, and other institutions. In more recent years, however, extensive studies of this nature have been made among urban school children. There is need for an extension of these investigations to rural communities, where measurements of school children of all classes will furnish representative standards.

Finally, the school building must be considered as a factory, exercising a marked influence on the physique of children. Indeed, observations made in other countries show greater physical development both in height and weight among children attending the better class schools.

Number of children studied.—A total of 2,488 rural school children[1] were studied during this survey. Of these, 1,253 were boys, and 1,235 were girls; showing an almost equal distribution of the sexes attending school.

The average daily attendance in these rural schools during the school year 1914–15 was 2,512 (2,264 for elementary schools; 248 for high schools). These examinations, therefore, are considered representative of the youthful population of the county. Because of a number of attendant circumstances, not every child was examined in all the details outlined in this report. The number of individuals furnishing data, however, is stated in all statistical tables based on physical measurements obtained during this survey.

Age of school entrants.—The proper age for a child to enter school is an educational problem which has not yet been solved satisfactorily. This is due largely to the relative influence of the personal equation of individual children, the home environment, and the community school facilities. This problem can not be settled fully without due investigation and an analysis of a great number of cases bearing on this point.

School attendance is compulsory in the State of Indiana from 6–14 years of age, and from 6–16 years of age for those children unable to show necessity for engaging in some gainful occupation.

In Porter County 25 boys and 31 girls were between 5 and 6 years of age, and but 86 boys and 111 girls attending the schools were over 15 years of age, as shown in the following table:

TABLE III.—*Age distribution by sex and one-year age periods.*

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
Boys	25	79	136	121	127	125	110	125	116	112	74	49	20	7	6	2	2	1,253
Girls	31	89	104	118	135	127	115	128	109	91	67	50	28	17	5	1	0	1,235

In chart 6 is plotted the curve of age distribution for both sexes. It is observed that practically one-half the children of either sex in school attendance were 10 years old and under, and that practically 8 per cent of the boys and 10 per cent of the girls were 6 years old and under, and less than 10 per cent of all the children of either sex were over 15 years of age.

[1] The enrollment was: Boys, 1,609; girls, 1,504; total, 3,113. The total number of unmarried persons between 6 and 21 in the county was 3,935 (males, 2,078; females, 1,857).

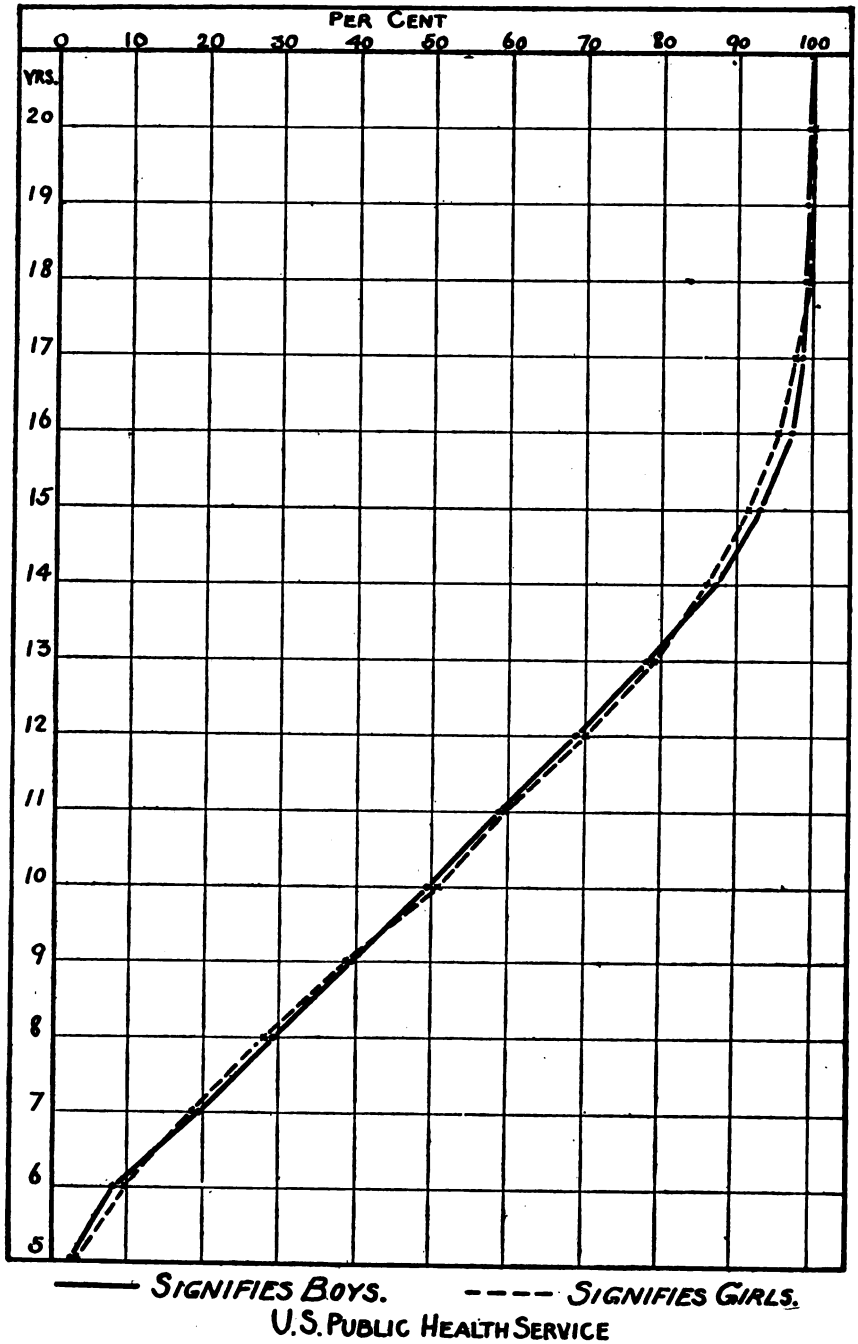


CHART 6.—Age distribution by sex for one-year periods of 1,236 boys and 1,215 girls attending the rural schools of Porter County.

According to the calculations of Prof. Thorndyke, 40 per cent of the children of New England cities of 25,000 inhabitants or more finished the eighth grade. In comparison, the number of children who finished the eighth grade in Porter County is small indeed. That fewer boys than girls from 14 to 17 years of age were attending school in this county is due probably to the demands of the farm being more insistent than those of domestic occupations.

PHYSICAL DATA.

HEIGHT AND WEIGHT.

Because of circumstances the height and weight of children were made in their ordinary clothing and shoes. Due allowance for this fact must be made in calculations of the exact weights and heights of the children here tabulated. According to the figures of Bowditch, the clothing of both sexes at 7 years of age weighs 3½ pounds, at 10 years of age, 5.7 pounds for boys and 4½ for girls, at 13 years of age, 7.4 pounds for boys and 5.6 for girls, and at 16 years of age, 9.7 pounds for boys and 8.1 pounds for girls. The height to be subtracted for shoes averages about seven-eighths of an inch. For practical purposes, however, these subtractions are unnecessary, because in all occupations where physical measurements are liable to be taken into consideration these are made with children wearing their ordinary clothing. It may be mentioned, however, that where children were wearing more than one coat or jacket these were removed before the weights were taken during this survey.

The rate of growth in both height and weight varies with the sex at different age periods.[1] Boys attending the rural schools of Porter County were taller than girls up to the ninth year, after which period the girls were taller than the boys up to the fourteenth year; from that age on the boys rapidly grew much taller than the girls.

The greatest rate of annual increase in height in boys was between 9 and 10 years of age (2.5 inches), 14 and 15 (2.7 inches), and 15 and 16 (2.5 inches). In girls it may be observed that the rate of annual increase was greatest between 9 and 10 years (2.7 inches),

[1] According to the anthropometrical committee of the British Association, quoted from Parks (Practical Hygiene):

Boys are heavier than girls up to 12, but soon after they lose their superiority for three years, regaining it at 16.

In boys the greatest increase occurs from 14–16; in girls from 12–15.

The rate of growth is irregular or interrupted. Boys are taller than girls up to 12, when girls pass them and retain an advantage to nearly 15.

In boys the greatest annual increases are from 5–6 (almost 3 inches), and from 14–15 (about 3 inches), namely, at the beginning and the end of elementary school education.

In girls the greatest annual increase is about 12.

In girls the annual increase is more uniform than in boys up to 14.

In girls the growth begins to slow down between 12 and 13, and at 14.5 girls have nearly completed their growth, while boys grow rapidly up to 19.

Girls of 13 and 14 are generally taller and heavier than boys of the same age.

and 12 and 13 (2.6 inches), which figures correspond very closely to those quoted above.

From 16 to 17 years of age there is a remarkable decline in the annual rate of increase in height of both boys and girls, corresponding to the maturation of the sexual functions in cold climates. The rate remains low in the case of girls, but continues high for boys during the two following years. It will be observed further on in this report that this decline is noticeable in all of the physical measurements recorded, but more noticeable in the case of girls.

Boys were heavier than the girls up to 9 years, and the girls were heavier than the boys from the ninth to the fifteenth year, at which period the weight of the girls declines quickly to rise again slowly. From 15 years of age on, the boys rapidly grow much heavier than the girls.

The greatest annual increase of weight in boys was between 15 and 16 years of age (14.8 pounds), the rate also being high between 14 and 15 years of age (10.3 pounds).

The greatest increase in weight of girls was between 14 and 15 years of age, followed by a decided decline between 15 and 16. The annual increase in weight of girls continued small from the sixteenth year on.

The decline in the annual rate of increase in weight of boys is not so decided as in the case of girls and occurs one year later, corresponding to a similar decline in the height rate.

MEAN HEIGHT AND WEIGHT.

A comparison of the mean height and weight of the Porter County school children to that of the children of other localities is shown in the following table:

TABLE IV.—*Mean height and weight of rural school children, Porter County, Ind., with comparative tables of height and weight, for one-year age periods.*

Age period.	Porter County, Ind.				Landois.		Boas.	
	Male.		Female.		Male.	Female.	Male.	Female.
	Height in inches.	Height in centimeters.	Height in inches.	Height in centimeters.	Height in centimeters.	Height in centimeters.	Height in inches.	Height in inches.
Years.								
5–6	46.73	118.6	44.74	113.6	99.0	97.0	41.7	41.3
6–7	47.17	119.8	46.66	118.2	104.6	103.2	43.9	43.3
7–8	48.73	123.7	47.98	121.8	111.2	109.6	46.0	45.7
8–9	49.61	126.0	49.67	126.1	117.0	113.9	48.8	47.7
9–10	52.08	132.2	52.35	132.9	122.7	120.0	50.0	49.7
10–11	54.09	137.3	53.96	137.0	128.2	124.8	51.9	51.7
11–12	55.50	140.9	55.67	141.1	132.7	127.5	53.6	53.8
12–13	57.51	146.0	58.27	148.0	135.9	132.7	55.4	56.1
13–14	58.70	149.0	60.06	152.5	140.3	138.6	57.5	58.5
14–15	61.40	155.9	61.83	156.9	148.7	144.7	60.0	60.4
15–16	63.93	159.7	62.63	159.0	153.9	147.5	62.9	61.6
16–17	64.52	163.8	63.01	159.5	161.0	150.0	64.9	62.0
17–18	66.67	166.7	63.63	161.5	167.0	154.4	66.5	62.7
18–19	68.96	175.1	63.57	161.4	176.0	156.2	67.4	.....

TABLE IV.—*Mean height and weight of rural school children, Porter County, Ind., etc.*—Continued.

Age period.	Porter County, Ind.				Landois.		Burke.	
	Male.		Female.		Male.	Female.	Male.	Female.
	Weight in pounds.	Weight in kilos.	Weight in pounds.	Weight in kilos.	Weight in kilos.	Weight in kilos.	Weight in pounds.	Weight in pounds.
Years.								
5–6	49.68	22.50	45.31	20.50	16.70	15.50	.....	.....
6–7	51.75	23.25	48.68	22.10	18.04	16.74	45.2	43.4
7–8	54.72	24.75	51.60	23.40	20.16	18.45	49.5	47.7
8–9	60.21	27.35	57.66	26.30	22.26	19.82	54.5	52.5
9–10	64.56	29.25	64.36	29.15	24.09	22.44	59.6	57.4
10–11	71.75	32.60	70.03	31.80	26.12	24.24	65.4	62.9
11–12	73.30	33.25	79.07	36.05	27.85	26.25	70.7	69.5
12–13	84.00	38.00	86.78	39.50	31.00	30.54	76.9	78.7
13–14	92.48	42.00	95.20	43.25	35.32	34.65	84.8	88.7
14–15	102.74	46.75	105.90	48.20	48.50	38.10	95.2	98.3
15–16	117.56	53.50	105.38	47.75	46.41	41.30	107.4	106.7
16–17	121.95	55.45	113.98	51.75	53.39	44.44	121.0	112.3
17–18	134.05	61.00	120.75	54.77	57.40	49.08	.....	115.4
18–19	140.00	63.75	117.23	53.40	61.26	53.10	.....	114.9

Age period.	Porter County, Ind.				Comparative table (Boas).			
	Absolute annual increase in height in inches.		Per cent absolute annual increase in height.		Absolute annual increase in height in inches.		Per cent absolute annual increase in height.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Years.								
6–7	0.44	1.9	0.9	4.2	2.2	2.0	5.3	4.8
7–8	1.56	1.3	3.3	2.7	2.1	2.4	4.8	5.5
8–9	.88	1.7	1.8	3.5	2.8	2.0	6.1	4.4
9–10	2.5	2.7	4.9	5.4	1.2	2.0	2.5	4.2
10–11	2.0	1.6	3.8	3.0	1.9	2.0	3.8	4.0
11–12	1.4	1.7	2.1	3.1	1.7	2.1	3.3	4.1
12–13	2.0	2.6	3.6	4.6	1.8	2.3	3.4	4.3
13–14	1.2	1.8	2.0	3.1	2.1	2.4	3.8	4.3
14–15	2.7	1.8	4.6	3.0	2.5	1.9	4.3	3.2
15–16	2.5	1.8	4.1	1.3	2.9	1.2	4.8	2.0
16–17	.6	.8	.9	.6	2.0	.6	3.2	1.0
17–18	2.2	.4	3.4	.9	1.6	.5	2.5	.8
18–19	2.3	.6	3.4	.....	.9	.....	1.4	.....

Age period.	Porter County, Ind.				Comparative table (Burke).			
	Absolute annual increase in weight, pounds.		Per cent absolute annual increase in weight.		Absolute annual increase in weight in pounds.		Per cent absolute annual increase in weight.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Years.								
6–7	1.5	3.4	3.0	7.5	.....	.....	.....	.....
7–8	3.6	2.9	7.0	5.9	4.3	4.3	9.5	9.9
8–9	5.5	6.0	10.1	11.6	5.0	4.8	10.1	10.0
9–10	4.4	6.7	7.3	11.6	5.1	4.9	9.3	9.3
10–11	7.2	5.7	11.1	8.9	5.8	5.5	9.7	9.6
11–12	1.6	9.0	2.2	12.8	5.3	6.6	8.1	10.5
12–13	10.7	7.7	14.1	9.7	6.2	9.2	8.7	13.2
13–14	8.5	8.3	10.1	9.5	7.9	10.6	10.3	12.7
14–15	10.3	10.7	11.1	11.3	10.4	9.6	12.3	11.9
15–16	14.8	−.5	14.4	−.4	12.2	8.4	12.8	8.5
16–17	14.4	8.6	12.2	8.2	13.6	5.6	12.7	5.2
17–18	12.1	6.8	10.0	5.9	.....	3.1	.....	2.8
18–19	6.0	−1.4	4.0	−1.1	.....	.....	.....	.....

TABLE IV.—*Mean height and weight of rural school children, Porter County, Ind., etc.*—Continued.

Age period.	Relation of annual increase in height of Porter County children to the comparative (Boas).				Relation of annual increase in weight of Porter County children to the comparative (Burke).			
	Absolute in inches.		Per cent.		Absolute in pounds.		Per cent.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Years.								
6–7	−1.8	−0.1	−4.4	−0.6	.....	.....	.....	.....
7–8	− .5	−1.1	−1.5	−2.8	−0.7	−1.4	−2.5	−3.6
8–9	−2.0	− .3	−4.3	− .9	+ .5	+1.2	.0	+1.6
9–10	+1.3	− .3	+2.4	+1.2	− .7	+1.8	−2.0	+2.3
10–11	+ .1	− .4	.0	−1.0	+1.4	+ .2	+1.4	− .7
11–12	− .3	− .4	−1.1	−1.0	−3.7	+2.4	−5.9	+2.3
12–13	+ .2	+ .3	+ .2	+ .3	+4.5	−1.5	+5.4	−3.5
13–14	− .9	− .6	−1.8	−1.2	+ .6	−2.3	− .2	−3.2
14–15	+ .2	− .1	+ .3	− .2	− .1	+ .9	−1.2	− .6
15–16	− .4	+ .6	− .7	− .7	+2.6	−8.9	+1.6	−8.9
16–17	−1.4	+ .2	−2.3	− .4	+ .8	+3.0	− .5	+3.0
17–18	+ .6	− .1	+ .9	+ .1	.....	+3.7	.....	.....

It may be observed that the mean height of boys of Porter County is less at the 6–7, 7–8, 8–9, 11–12, 13–14, 15–16, and 16–17 age periods. The girls in comparison are under the mean height at 12–13, 15–16 and 16–17 year age periods. The per cent of deficiency ranges from 0.7 per cent to 2.3 per cent among the boys and 0.2 per cent to 2.8 per cent among the girls.

With regard to weight, the boys are under the mean at the 7–8, 9–10, 10–12, and 14–15 year age periods. The girls are under the mean weight at the 7–8, 12–13, 13–14, and 15–16 year age periods. The per cent of weight deficiency varies from 0.2 per cent to 5.9 per cent among boys and 0.6 per cent to 8.9 per cent among the girls.

RACIAL DIFFERENCES IN PHYSICAL DEVELOPMENT.

In Table V is given the statistical tabulation of the mean physical measurements of 2,488 school children of the county compared to similar mean measurements of 364 boys and 377 girls of the county who were either foreign born or of parents one or both of whom were of foreign birth:

TABLE V.—*Mean physical measurements of all children attending the rural schools of Porter County, Ind., 1914–15, compared with those of 364 boys and 377 girls who are foreign born or have one or both parents foreign born.*

[Classified by race, sex, and 1-year age periods.]

Race.	Males.										
	Age period.	Cases furnishing data.	Mean height.	Mean weight.	Vital capacity.	Chest expansion.	Dynamometer.		Cephalic index.		
							Right.	Left.	Dolichocephalic.	Mesaticephalic.	Brachycephalic.
	Yrs.		*Inches.*	*Lbs.*	*Cu. in.*	*Inches.*	*Kilos.*	*Kilos.*	*Per ct.*	*Per ct.*	*Per ct.*
All races	5-6	25	46.73	49.68	.....	.....	.....	.....	52.20	34.80	13.00
Scandinavians	5-6	1	47.00	49.00	35.00	1.75	5.00	5.00	.....	100.00	.....
All races	6-7	78	47.17	51.15	.....	.....	.....	.....	46.00	31.00	23.00
Dutch	6-7	1	46.00	57.00	45.00	1.50	8.00	8.00	100.00	.....	.....
German	6-7	7	48.50	53.42	36.15	2.08	8.7	8.7	57.10	42.90	.....
Polish	6-7	6	46.37	57.50	50.00	2.25	8.3	6.3	.....	15.75	84.25
Scandinavian	6-7	7	47.50	51.00	48.23	1.80	8.0	6.2	85.70	14.30	.....
All races	7-8	139	48.73	54.42	46.62	2.00	9.2	8.4	34.00	43.75	22.25
English, Scotch, Irish	7-8	3	47.91	53.33	35.00	2.35	8.7	10.6	33.33	66.66	.....
German, etc	7-8	9	49.50	58.22	52.75	1.90	10.5	9.4	11.10	77.80	11.10
Polish, etc	7-8	10	47.77	53.10	37.55	1.95	9.6	9.2	10.00	20.00	20.00
Scandinavian	7-8	13	49.23	55.00	48.00	2.00	9.1	6.5	25.00	75.00	.....
All races	8-9	123	49.61	60.21	61.72	2.21	11.2	10.1	33.75	41.25	25.00
English	8-9	3	50.75	55.66	57.65	3.00	10.0	11.5	33.33	33.33	33.33
German	8-9	14	57.10	57.57	65.35	2.10	11.6	10.3	14.25	71.50	14.25
Polish	8-9	6	50.54	60.00	61.65	2.05	12.7	11.3	33.33	16.67	50.00
Scandinavian	8-9	11	49.11	59.63	60.00	2.15	10.9	10.0	45.45	36.35	18.10
All races	9-10	131	52.08	64.56	71.71	2.43	11.7	11.3	37.00	48.75	14.25
Dutch	9-10	1	51.50	67.00	60.00	2.00	15.0	11.5	100.00	.....	.....
English	9-10	2	52.25	67.50	67.50	2.50	.....	.....	50.00	.....	50.00
German	9-10	13	50.48	64.07	70.35	2.40	13.4	12.3	23.10	38.45	38.45
Polish	9-10	11	52.29	65.63	65.90	2.55	13.6	12.0	9.10	27.25	63.65
Scandinavian	9-10	14	52.08	63.07	72.50	2.40	11.0	9.7	61.55	30.75	7.70
All races	10-11	124	54.00	71.75	87.01	2.59	14.3	13.4	40.50	44.50	15.00
Dutch	10-11	1	54.00	68.00	100.00	3.00	11.5	11.5	100.00	.....	.....
English	10-11	5	53.54	67.60	65.00	3.00	13.4	14.4	80.00	20.00	.....
German	10-11	15	55.95	81.86	106.35	2.55	16.2	15.4	46.65	40.00	13.35
Italian	10-11	1	51.00	65.00	55.00	2.00	8.0	8.0	.....	100.00	.....
Polish	10-11	10	56.15	72.77	92.00	2.65	14.6	12.8	.....	60.00	40.00
Scandinavian	10-11	12	52.74	69.25	75.00	2.45	14.7	14.5	58.25	41.75	.....
All races	11-12	110	55.50	75.30	93.72	2.29	15.0	13.6	39.25	43.50	17.25
Dutch	11-12	1	56.25	85.00	145.00	3.00	16.9	18.5	.....	100.00	.....
English, etc	11-12	2	54.00	63.50	75.00	2.10	12.4	11.5	.....	100.00	.....
German	11-12	16	56.48	78.75	96.25	2.55	17.5	15.1	25.00	37.50	37.00
Polish	11-12	8	52.12	66.62	66.60	2.45	12.7	11.8	.....	25.00	75.50
Scandinavian	11-12	12	55.45	78.66	91.25	2.40	15.9	15.0	41.60	50.00	8.40
All races	12-13	123	57.51	84.60	110.25	2.89	17.3	16.5	37.35	47.20	15.45
Dutch	12-13	1	57.75	87.00	135.00	3.00	18.5	20.3	100.00	.....	.....
English	12-13	2	57.25	85.00	127.00	3.25	18.5	17.8	100.00	.....	.....
German	12-13	15	56.16	78.86	104.65	2.50	16.9	15.7	42.85	42.85	14.30
Polish	12-13	12	58.21	88.12	125.00	2.55	18.5	16.1	14.30	57.15	28.55
Scandinavian	12-13	12	60.08	84.08	104.85	2.75	18.4	16.2	75.00	16.65	8.35
All races	13-14	116	58.70	92.48	127.46	2.85	19.6	17.0	36.00	46.00	18.00
Dutch	13-14	1	60.25	101.00	165.00	2.50	20.3	16.9	.....	.....	100.00
English	13-14	3	58.91	114.00	118.35	2.50	20.3	17.8	66.66	33.33	.....
French	13-14	1	61.00	90.00	100.00	3.50	25.5	18.5	.....	.....	.....
German	13-14	13	60.60	100.15	138.20	3.60	22.3	19.8	28.55	57.15	14.30
Polish	13-14	5	59.70	99.40	141.00	2.70	20.3	18.9	.....	75.00	25.00
Scandinavian	13-14	11	58.50	93.45	136.50	2.75	20.4	19.3	50.00	40.60	10.00
All races	14-15	112	61.41	102.74	147.34	2.87	24.0	21.9	42.65	41.10	15.75
Austrian	14-15	1	54.25	67.00	90.00	3.00	15.0	15.0	100.00	.....	.....
English	14-15	2	64.12	117.00	160.00	3.50	24.8	24.8	100.00	.....	.....
German	14-15	15	61.33	109.13	157.35	.....	23.8	23.0	43.00	57.00	.....
Polish	14-15	6	58.25	103.00	131.00	2.40	23.1	21.9	16.65	50.00	33.35
Scandinavian	14-15	14	61.50	103.35	160.00	2.95	25.2	24.2	46.25	38.45	15.30

TABLE V.—*Mean physical measurements of all children attending the rural schools of Porter County, Ind., 1914–15, etc.*—Continued.

Race.	Age period.	Cases furnishing data.	Mean height.	Mean weight.	Vital capacity.	Chest expansion.	Dynamometer.		Cephalic index.		
							Right.	Left.	Dolichocephalic.	Mesaticephalic.	Brachycephalic.
Males.											
	Yrs.		*Inches.*	*Lbs.*	*Cu. in.*	*Inches.*	*Kilos.*	*Kilos.*	*Per ct.*	*Per ct.*	*Per ct.*
All races	15–16	72	63.93	117.56	180.42	3.11	28.6	27.9	35.10	43.25	21.65
Austrian	15–16	1	62.50	127.00	175.00	2.25	29.0	29.0	.....	.....	100.00
English	15–16	2	64.37	123.00	160.00	3.60	23.8	21.3	100.00	.....	.....
German	15–16	9	65.50	111.77	163.35	3.00	25.0	25.0	42.50	57.50	.....
Polish	15–16	5	60.23	113.00	113.00	2.35	21.5	22.4	.....	40.00	60.00
Roumanian	15–16	1	53.50	130.00	260.00	3.50	30.8	35.5	.....	.....	100.00
Scandinavian	15–16	6	64.50	122.35	197.50	3.85	31.7	29.0	66.66	33.33	.....
All races	16–17	48	64.52	121.95	188.75	3.29	30.2	26.8	38.35	51.00	10.65
English	16–17	3	64.50	113.35	175.00	4.50	30.8	28.5	33.33	66.66	.....
German	16–17	1	66.50	125.00	185.00	3.50	20.3	18.5	.....	100.00	.....
Scandinavian	16–17	7	64.07	115.85	172.15	3.20	30.0	27.0	57.15	14.30	28.55
Females.											
	Yrs.		*Inches.*	*Lbs.*	*Cu. in.*	*Inches.*	*Kilos.*	*Kilos.*	*Per ct.*	*Per ct.*	*Per ct.*
All races	5–6	29	44.74	45.31	.....	.....	.....	.....	44.85	31.00	24.50
English	5–6	1	41.50	40.00	.....	.....	3.00	3.00	100.00	.....	.....
German	5–6	2	45.37	49.00	32.54	.....	3.00	3.00	50.00	50.00	.....
All races	6–7	90	46.66	48.68	.....	.....	.....	.....	46.15	35.85	18.00
English	6–7	2	45.75	45.00	17.50	.....	8.00	8.00	100.00	.....	.....
German	6–7	7	49.85	48.55	38.35	1.50	8.00	6.1	42.85	42.85	14.30
Italian	6–7	1	46.00	50.00	20.00	.....	.....	.....	100.00	.....	.....
Polish	6–7	4	47.00	49.50	36.65	1.35	8.00	8.00	25.00	.....	75.00
Scandinavian	6–7	9	46.00	46.65	26.25	2.00	5.00	5.00	50.00	50.00	.....
All races	7–8	105	47.98	51.60	37.45	2.05	8.0	6.2	35.20	52.35	11.45
English	7–8	3	48.41	52.65	41.65	2.00	.....	.....	33.33	66.66	.....
German	7–8	10	48.60	52.60	41.50	1.60	10.0	9.6	20.00	40.00	40.00
Italian	7–8	1	46.50	52.00	35.00	1.50	8.0	8.0	.....	100.00	.....
Polish	7–8	3	48.25	50.35	26.65	2.00	5.0	5.0	.....	100.00	.....
Scandinavian	7–8	9	48.75	53.44	41.65	1.90	11.6	11.5	55.55	33.35	11.10
All races	8–9	120	49.67	57.66	48.31	1.94	8.8	8.0	42.75	45.30	11.95
English	8–9	3	49.58	55.00	48.35	1.50	8.0	8.0	66.66	33.33	.....
German	8–9	17	43.85	57.75	47.50	1.85	9.2	8.4	25.00	56.25	18.75
Polish	8–9	10	50.20	61.10	38.00	1.60	9.0	7.5	20.00	50.00	30.00
Scandinavian	8–9	9	50.15	58.90	56.65	2.15	8.2	8.2	44.45	22.20	33.35
All races	9–10	133	52.35	64.36	58.73	2.17	10.5	9.6	44.15	42.25	13.30
English	9–10	1	49.20	56.00	55.00	2.50	10.0	8.0	.....	.....	.....
German	9–10	12	53.15	71.60	59.50	2.20	11.4	10.5	45.45	54.55	.....
Polish	9–10	9	53.75	61.20	50.00	1.85	10.4	9.4	22.20	33.35	44.45
Roumanian	9–10	1	54.00	74.00	90.00	2.00	11.5	11.5	.....	100.00	.....
Scandinavian	9–10	10	51.40	59.00	56.65	1.80	9.1	7.4	88.90	11.10	.....
All races	10–11	129	53.96	70.03	69.81	2.49	11.4	10.4	40.50	43.00	16.50
Austrian	10–11	1	55.00	54.00	35.00	2.75	10.0	10.0	.....	100.00	.....
English	10–11	1	52.25	54.00	65.00	3.00	13.4	11.5	.....	.....	.....
French	10–11	1	57.75	82.00	100.00	3.00	15.0	11.5	100.00	.....	.....
German	10–11	13	54.55	75.70	73.85	2.65	14.0	12.8	46.20	38.45	15.35
Polish	10–11	9	52.70	65.10	61.10	2.00	11.2	10.4	11.10	44.45	44.45
Scandinavian	10–11	17	54.20	71.65	72.50	2.40	11.2	10.4	56.20	37.55	6.25

TABLE V.—*Mean physical measurements of all children attending the rural schools of Porter County, Ind., 1914–15, etc.*—Continued.

Race.	Females.										
	Age period.	Cases furnishing data.	Mean height.	Mean weight.	Vital capacity.	Chest expansion.	Dynamometer.		Cephalic index.		
							Right.	Left.	Dolichocephalic.	Mesaticephalic.	Brachycephalic.
	Yrs.		*Inches.*	*Lbs.*	*Cu. in.*	*Inches.*	*Kilos.*	*Kilos.*	*Per ct.*	*Per ct.*	*Per ct.*
All races	11–12	114	55.67	79.07	83.38	2.51	13.7	12.2	36.50	51.00	12.50
Belgian	11–12	1	54.25	41.00	100.00	2.75	18.5	16.9	.....	100.00	.....
English	11–12	1	55.50	85.00	70.00	2.50	11.5	10.0	.....	.....	.....
German	11–12	13	56.15	77.40	87.70	2.50	13.3	11.4	27.40	54.40	18.20
Polish	11–12	7	53.75	65.30	50.70	2.00	11.6	11.3	.....	71.45	28.55
Scandinavian	11–12	18	56.65	76.95	78.60	2.45	13.3	12.3	31.25	25.00	43.75
All races	12–13	128	58.27	86.78	87.54	2.68	15.0	12.7	43.00	44.10	12.40
English	12–13	4	56.95	77.75	68.35	2.25	13.4	14.0	75.00	25.00	.....
German	12–13	16	59.15	91.60	86.25	2.60	15.6	14.4	68.75	31.25	.....
Polish	12–13	7	56.90	75.85	76.15	2.55	14.7	13.9	50.00	35.33	16.66
Scandinavian	12–13	10	58.65	93.10	97.00	2.70	17.5	14.6	60.00	40.00	.....
All races	13–14	109	60.06	95.20	96.57	2.78	17.6	15.6	37.20	48.30	14.50
English	13–14	2	59.00	78.00	67.50	2.60	13.4	14.4	100.00	.....	.....
German	13–14	20	60.21	98.55	102.00	2.70	17.7	16.5	40.00	50.00	10.00
Polish	13–14	8	58.56	86.25	71.25	2.40	16.9	14.6	16.65	16.65	66.70
Scandinavian	13–14	12	59.35	89.75	100.40	2.75	17.3	16.2	75.00	12.50	12.50
All races	14–15	91	61.83	105.90	110.00	2.77	20.2	16.1	49.40	50.00	10.60
English, Scotch, Irish	14–15	6	60.70	99.33	117.50	2.25	17.5	13.7	20.00	80.00	.....
German	14–15	10	60.97	109.30	106.50	2.50	21.0	17.8	20.00	60.00	20.00
Polish	14–15	9	61.61	109.77	95.60	2.95	21.2	18.5	.....	85.75	14.25
Scandinavian	14–15	18	60.00	102.50	98.60	2.60	18.4	20.3	68.25	28.55	7.20
All races	15–16	67	62.63	105.38	114.32	3.00	20.1	17.9	51.40	45.75	2.85
English	15–16	4	62.06	94.50	102.50	2.60	18.5	18.0	100.00	.....	.....
German	15–16	10	63.52	111.42	104.50	2.90	20.5	17.4	40.00	40.00	20.00
Polish	15–16	1	59.00	87.00	65.00	2.50	18.5	15.0	.....	100.00	.....
Scandinavian	15–16	8	64.53	113.12	126.25	3.30	22.9	19.7	.....	100.00	.....
All races	16–17	50	63.01	113.98	119.37	3.00	21.0	18.8	60.00	28.00	12.00
Belgian	16–17	1	61.25	116.00	110.00	3.25	30.8	25.5	.....	.....	.....
German	16–17	3	63.41	106.33	136.65	3.25	22.0	18.5	100.00	.....	.....
Polish	16–17	1	63.75	118.00	110.00	2.50	20.3	18.5	.....	100.00	.....
Scandinavian	16–17	1	63.25	114.00	175.00	3.50	25.5	25.5	.....	.....	.....

In general, the mean height and weight of children of German, Polish, and Scandinavian origin were greater than the corresponding heights and weights for the county as a whole. Of these, boys of German origin were tallest at the 6–7, 7–8, 8–9, 11–12, 13–14, 15–16, and 16–17 year age periods, the Polish at the 9–10 and 10–11 year age periods, and Scandinavian at the 12–13 and 14–15 year age periods. In weight, the boys of German origin were heavier at the 8–9, 10–11, 11–12, 14–15, and 16–17 year age periods, boys of Polish origin at the 6–7 and 13–14 year age periods, and boys of Scandinavian origin at the 7–8, 9–10, and 15–16 year age periods.

In the case of girls, those of German origin were the tallest at the 6–7, 10–11, 12–13, and 13–14 year age periods, Scandinavian at the 7–8, 11–12, and 15–16 year age periods, and the Polish girls at the 8–9. 9–10, 14–15, and 16–17 year age periods.

With regard to weight, the girls of Polish extraction were the heaviest at the 6–7, 8–9, 14–15, and 16–17 year age groups, and the German at the 9–10, 11–12, and 13–14 year age periods.

The number of units in each of these nationality groups was too small to give more than approximate results. In the cases quoted, however, the collected data are sufficient to warrant the statement that the mean height and weight for the county at large has not been reduced by the admixture of these elements.

VITAL CAPACITY.

The mean vital capacity was determined in the case of 1,122 boys and 1,079 girls, using the dry spirometer for this purpose. Detachable glass mouthpieces were made use of, a special mouthpiece being furnished each child which was sterilized in every case before it was used again.

Vital capacity is influenced by a number of factors. Of these may be mentioned stature, body weight, age, sex, and occupation. It increases with age, attaining the maximum at about the thirty-fifth year; it is greater for men than for women, the average for the former being about 3,700 cubic centimeters and for women 2,500 cubic centimeters. The vital capacity is also influenced by posture and the condition of the stomach, being greater in the standing position and when the stomach is empty.

The mean vital capacity of the rural school children of Porter County is plotted in chart 7, showing interesting differences between the sexes. The rise of lung capacity is constant in boys from the seventh to the eighteenth year, the curve showing a decided break between the fifteenth and sixteenth years, corresponding to the decline in rate of increase of other physical measurements observed at this age period.

In the case of girls, however, the increase in vital capacity is similar to that for boys up to the eleventh year, the only difference being the lesser capacity influenced by sex. At this period of life the outdoor activities of girls are very much the same as those of boys of the same age. From this time on girls begin to wear corsets, though their outdoor activity may continue for a period. The effect of these changes is reflected probably by the vital capacity curve which falls away from that for the boys and continues to decline gradually to the fourteenth year. After the fourteenth year, the average girl becomes more sedate, her outdoor activities are lessened, and she undergoes certain functional disturbances which are reflected by an obvious decline in the vital capacity increase. This continues to the seventeenth year, after which there is a still more decided fall.

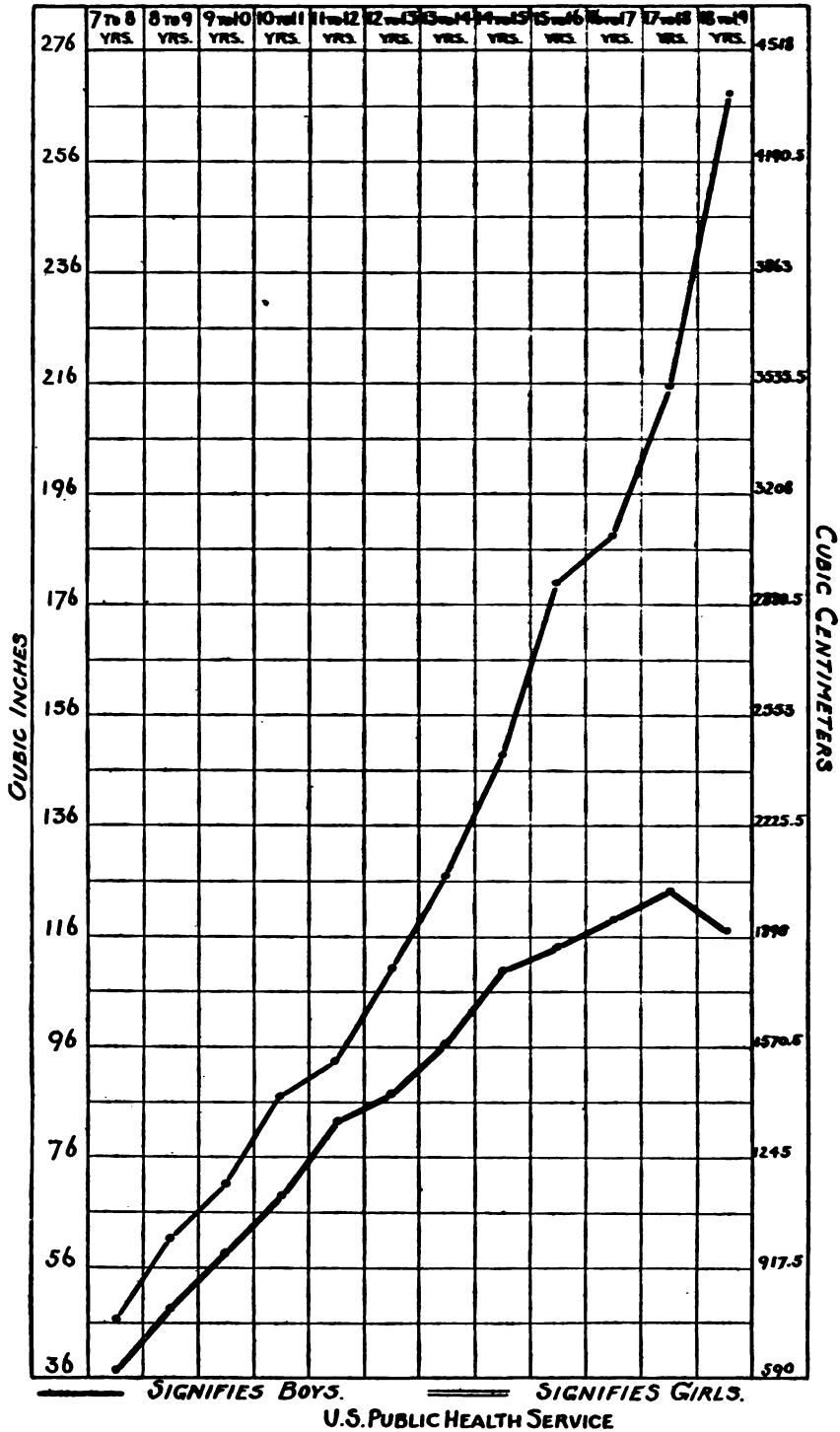


CHART 7.—Mean vital capacity in cubic inches of 1,122 boys and 1,079 girls from 7 to 18 years of age attending Porter County rural schools.

CHEST EXPANSION.

Measurements of the mean chest expansions were made in the case of 1,122 boys and 1,079 girls (see chart 8). The chest expansion for boys rose gradually from less than 1 inch at the sixth year to nearly

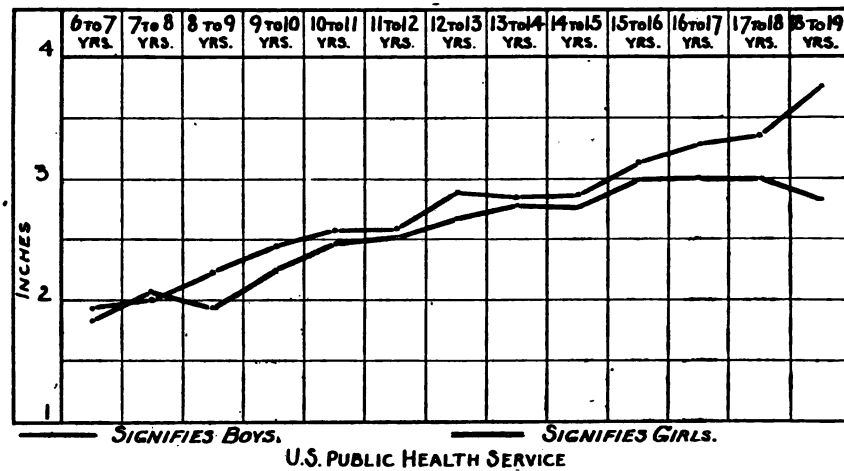


CHART 8.—Chest expansion in inches of 1,046 boys and 1,029 girls from 6 to 18 years of age attending the rural schools of Porter County.

4 inches at the eighteenth year. In the case of girls the rise was likewise gradual from less than 1 inch at the sixth year to a maximum of about 3 inches at the fifteenth year. It remained practically stationary for girls from 15 to 16 and declined sharply between 17 and 18.

DYNAMOMETER TESTS.

The muscular strength of the hands of boys increased constantly from the seventh to the eighteenth year. A slight decline in the rate took place between the fifteenth and sixteenth year. In girls, the rate of increase was also fairly constant and remained stationary between the fifteenth and sixteenth year, corresponding in this respect to other physical measurements of girls at this age period (see chart 9, page 77).

There were recorded 25 cases of left-handedness, 19 among the boys and 6 among the girls.

CEPHALIC INDEX.

The size and shape of the head is determined largely by environment, sex, and race. The ethnical significance of these cephalic measurements is great when employed in communities having racially mixed populations to determine the extent of amalgamation of races and to explain certain habits, customs, and trends of mind.

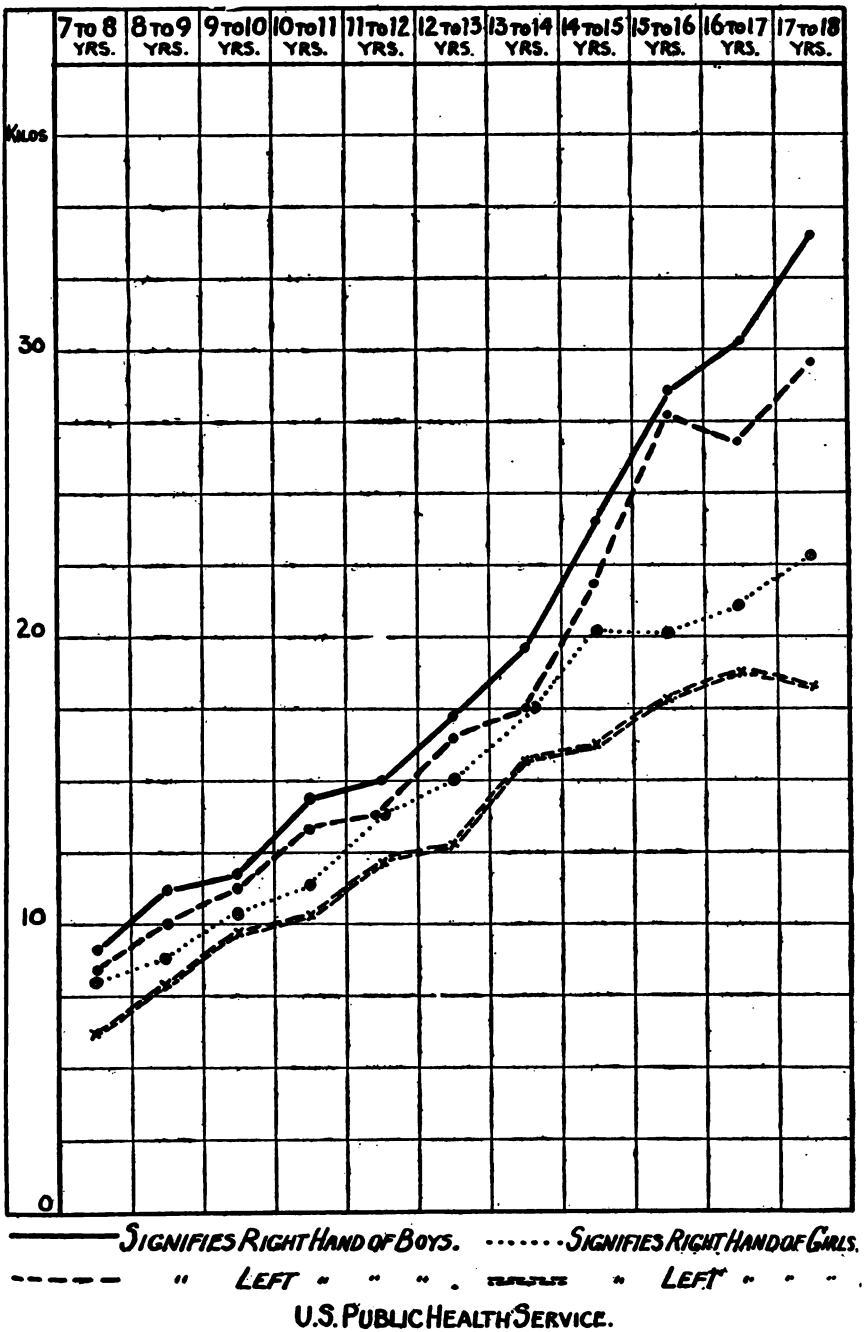


CHART 9.—Average muscular strength of the hands of 987 boys and 920 girls attending Porter County rural schools.

The shape of the head has been tabulated in Table V in the case of 1,195 boys and 1,055 girls and classified according to sex and one-year age periods. Of the boys, 38.15 per cent were dolichocephalic, 44 per cent mesaticephalic, and 17.85 per cent brachycephalic. Of the girls, 41.8 per cent were dolichocephalic, 44.7 per cent mesaticephalic, and 10.5 per cent brachycephalic. In other words, 84.35 per cent of all these children were either long headed or round headed, and 15.65 per cent were broad headed.

It is interesting to observe in Table V (p. 71) that the highest per cent of dolichocephalic children of German, Scandinavian, and Polish extraction was observed among those of Scandinavian origin, and the highest per cent of the brachycephalic of the same extraction among children of Polish origin. These results are of great ethnical significance, though they may receive but passing notice in a report of this nature.

PULSE AND RESPIRATION RATE.

The rate of the pulse and respiration are influenced by age, sex, emotions, and many other factors. The average respiration rate per minute of 1,208 boys decreased gradually from 21.1 at the fifth year to 16.8 at the sixteenth year, rising again during the following two years, beyond which age the cases herein recorded are too few to give reliable indications. Although not so regularly as in the case of respiration, the pulse rate of 1,196 boys likewise decreased from 92.05 per minute at the sixth year to 78 at the seventeenth year, above which age period the number of observations recorded are too few to compensate for the influences of emotion and exercise on the pulse rate.

The average respiration per minute of 1,193 girls decreased gradually from 21.3 at the fifth year to 16.3 at the nineteenth year. A noticeable decline in the average respiration rate is recorded at the seventeenth year. The average pulse rate of 1,193 girls per minute decreased from 94.26 per minute at the fifth year to 74 per minute at the nineteenth year. Variation in the pulse rate at different age periods was more marked in the case of girls than that of boys, which is probably accounted for by a more emotional temperament in the case of the former.

NUTRITION.

Observations on the nutrition of the pupils were made in the course of these examinations. The accuracy of these observations must necessarily be purely relative. The nutrition of 28 of the boys and 27 of the girls was considered fair. The development of 231 boys, roughly 18 per cent of the total examined, and of 207 girls, or 16 per cent of the total, was fair.

Hemoglobin.—While the value of hemoglobin determinations as an index of nutrition is unquestioned, these tests could not be made generally. However, 158 boys were examined in this respect, using the Von Talquist scale. Of these, 3 boys had a hemoglobin per cent of 75; 16 of 80; 51 of 85; 77 of 90, and 11 of 95 per cent. Of the girls, 130 in number, 18 had a hemoglobin per cent of 80; 29 of 85; 70 of 90; and 13 of 95 per cent. These determinations correspond quite closely to the observations relative to the nutrition of the pupils in the county as a whole.

Diet.—As having a bearing on nutrition, observations were made with respect to the habitual use of certain articles of food by the school children of the county. The rôle of food in the causation of disease is becoming increasingly apparent. The effect of diet on scurvy has been known for a long time. A faulty food supply is definitely related to beriberi, and only quite recently it has been determined that a diet deficient in certain proteids stands in direct causative relation to the wide prevalence of pellagra.

The breakfast of 901, or 40 per cent of the total children reporting, was composed of carbohydrates principally, and that of 1,338, practically 60 per cent, was a mixed diet of carbohydrates and proteids. In addition, 1,277 children, or 57 per cent of the total, used coffee for breakfast, while only 315 children, or 15 per cent of those reporting, used milk. This condition is remarkable in an agricultural community in which dairy farming is so largely practiced. With respect to the use of starchy food, 839 children, or 37 per cent, had potatoes for breakfast, and 735 children, or 32 per cent, had some form of prepared cereal. Of the children whose breakfast contained some form of proteids 973, or 43 per cent, ate eggs for breakfast and 544, or 23 per cent, meat in some form, usually pork.

Of the total reporting, 29 children did not eat breakfast habitually. In addition, the breakfast of a number of other children was defective, largely through capriciousness of the appetite rather than inability of the parents to provide the necessary food supply. Examples of this capriciousness may be seen in the case of some children who reported that their breakfast was composed of bread and coffee, pancakes, tea and crackers, coffee cake and coffee, pumpkin pie and coffee, an orange only in two instances, coffee and bread and lard in two other instances. This last observation is of peculiar interest in that it shows the retention of a custom or habit brought from the old country, because among certain Polish people lard is used on bread instead of butter, as a matter of choice.

Parents should be impressed with the necessity of providing children with a substantial breakfast before proceeding to school, because, in the cases where children live too far from the school to return for lunch, the amount of nourishment consumed by reason of

these limitations is too small to afford proper nourishment. The child, improperly fed and poorly nourished, can not do effective work, either physical or mental. An empty stomach is incompatible with the acquirement of mental training. The requirements of a desirable diet are: That it be sufficient in amount, varied and well balanced, contain starches and sugars to furnish heat and energy, and proteids, most readily available in the form of beans, milk, eggs and fresh meat, for the repair and upbuilding of growing tissues.

DEFECTS AND DISEASES FOUND.

The belief is quite common that a greater number of rural school children suffer from physical defects than is the case in cities, because of the greater medical facilities enjoyed by the latter. When compared with the reports of inspections made in urban communities, the results of this survey do not confirm this belief. The fact remains, however, that an undue number of the children in rural schools are found suffering from the results of the misuse of the special senses and from diseases of these organs which require the services of specialists, unfortunately denied in great measure to this large part of the general population.

In the following table is given the statistical results of the medical examination of the children of Porter County:

TABLE VI.—*Physical defects found in an examination of 2,488 children attending the rural schools of Porter County, Ind.*

BOYS.	Number.
Circulatory system:	
Irregular heart action	2
Valvular disease of	5
Extremity, upper:	
Ankylosis—	
First and second fingers, right	1
First finger, left	1
Second joint, fourth finger, right	1
Third joint, second finger, right	1
Fourth finger, left	1
Contracture—	
First and second fingers, right	1
Fourth finger, left	1
Deformity—	
First, second, and fourth fingers, left	1
Left forearm (old fracture)	1
Fracture—	
Bones, left forearm, recent	1
Colle's, left, recent	1
Hearing, defects of (see Tables VII and VIII)[1]	392
Hernia:	
Inguinal—	
Left	3
Right	1
Umbilical, relaxed ring	1
Nervous system, paralysis, hemiplegia, cerebral type:	
Left	1
Right	1
Nose and throat:	
Adenoids[2]	166
Nasal catarrh, chronic	16
Nasal septum, deflected	13
Nasal spur	14

[1] Tonsils and adenoids associated with defective hearing in 97 cases.
[2] Adenoids associated with enlarged tonsils in 140 cases.

TABLE VI.—*Physical defects found in an examination of 2,488 children attending the rural schools of Porter County, Ind.*—Continued.

BOYS.	Number.
Nose and throat—Continued.	
Pharyngitis—	
Catarrhal, subacute	5
Chronic, atrophic	2
Chronic, hypertrophic	16
Soft palate, cleft	1
Tonsils—	
Enlarged	89
Requiring surgical treatment	106
Respiratory system, general, bronchitis, subacute	15
Skin:	
Eczema	3
Impetigo	3
Ringworm of the face	2
Ringworm of the scalp	2
Speech, defective	8
Spinal curvature:	
Functional	25
Organic	2
Systemic: Pretubercular	2
Teeth, defective	749
Vision, defective (see Tables IX and X)	592
Total defects for boys	2,228

GIRLS.	Number.
Circulatory system:	
Irregular heart action	1
Valvular disease of	3
Extremity, lower:	
Shortening of left leg, coxitis	1
Ankylosis, left hip, incomplete	1
Extremity, upper:	
Ankylosis—	
Second finger, left	1
Fourth finger, both hands	1
Second joint, fourth finger, right	1
Deformity—	
Fourth finger, left hand	1
Fourth finger, both hands	1
Rudimentary fingers, fourth, both hands	2
Hearing, defects of (see Tables VII and VIII)[1]	348
Nervous system:	
Paralysis—	
Infantile, both legs	1
Spastic (infantile and cerebral type)	1
Infantile	1
Nose and throat:	
Adenoids[2]	122
Nasal catarrh, chronic	10
Nasal septum, deflected	6
Nasal spur	9
Pharyngitis—	
Catarrhal, subacute	8
Chronic, atrophic	1
Chronic, hypertrophic	31
Tonsils—	
Enlarged	106
Requiring surgical treatment	84
Uvula absent	1
Respiratory system, general:	
Asthma	1
Bronchitis, subacute	17
Tuberculosis	2
Skin:	
Impetigo	3
Ringworm of the face	3
Ringworm of the scalp	1
Speech, defective	6
Spinal curvature:	
Functional	11
Organic	2
Systemic: Pretubercular	10
Teeth, defective	637
Vision, defective (see Tables IX and X)	550
Total defects for girls	1,985

[1] Tonsils and adenoids associated with defective hearing in 80 cases.
[2] Adenoids associated with enlarged tonsils in 110 cases.

In this table it will be observed that, although the school population of the county is almost equally divided between the sexes, 1,253 boys and 1,235 girls, defects associated with the organs of hearing were more prevalent among the boys to the extent of 31.2 per cent compared to 28.2 per cent among the girls, affections of the respiratory system including the upper air passages in 35.4 per cent of the former and 32.2 per cent of the latter, and defects of the visual apparatus in 47.2 per cent and 45.5 per cent of the boys and girls, respectively. A number of these defects, however, were of minor character. Their relative significance will be discussed under special headings.

CIRCULATORY SYSTEM.

Surprisingly few of the children examined during this survey presented grave disturbances of the circulatory system. Of the boys, only five were noted with valvular disease of the heart and two with irregular heart action. Among the girls were found three cases of valvular disease of the heart and one of irregular heart action.

DEFORMITIES OF THE EXTREMITIES.

Defects of both the upper and lower extremities encountered were of minor importance, the results in the main of minor accidents. They consisted largely of ankylosis of one or both joints of the fingers and of deformities following fracture of the long bones. In the case of the lower extremity, however, one girl was suffering from shortening of the leg due to a former inflammation of the hip joint and one from partial ankylosis of the hip due to the same cause.

DEFECTIVE HEARING.

Auditory acuteness was determined by a watch calibrated for the normal ear. Hearing was expressed in the form of a fraction, the distance at which a watch could be heard by the normal ear being the denominator and the distance at which it was actually heard by the child examined, the numerator. In Table VII is given the results of the tests of hearing made in this manner:

TABLE VII.—*Degree of impairment of hearing, in terms of tenths of the normal distance, in 164 boys and 140 girls with defective hearing attending the rural schools of Porter County, Ind., 1914–15.*

Boys.			Girls.		
Right hearing.	Left hearing.	Number.	Right hearing.	Left hearing.	Number.
0/0	3/10	1	0/0	8/10	1
1/10	1/10	3	1/10	1/10	2
1/10	2/10	1	1/10	2/10	1
1/10	3/10	3	1/10	10/10	3
1/10	10/10	1	10/10	1/10	1
2/10	1/10	1	2/10	4/10	1
5/10	1/10	2	2/10	10/10	2
10/10	1/10	1	4/10	2/10	1
2/10	2/10	2	5/10	2/10	1
2/10	3/10	1	6/10	2/10	1
2/10	7/10	1	10/10	2/10	2
5/10	2/10	1	3/10	3/10	2
3/10	4/10	2	3/10	9/10	1
3/10	10/10	1	4/10	3/10	1
10/10	3/10	2	10/10	3/10	1
4/10	4/10	2	4/10	4/10	1
4/10	5/10	1	4/10	5/10	1
4/10	7/10	1	4/10	6/10	1
4/10	8/10	1	4/10	8/10	1
4/10	9/10	1	4/10	10/10	2
4/10	10/10	2	8/10	4/10	1
6/10	4/10	3	10/10	4/10	10
8/10	4/10	1	5/10	5/10	1
10/10	4/10	3	5/10	7/10	1
5/10	5/10	1	5/10	8/10	2
5/10	6/10	1	6/10	6/10	7
5/10	9/10	1	6/10	7/10	2
5/10	10/10	4	6/10	8/10	4
9/10	5/10	1	6/10	9/10	1
10/10	5/10	2	7/10	6/10	1
6/10	6/10	8	8/10	6/10	1
6/10	7/10	1	9/10	6/10	1
6/10	8/10	2	10/10	6/10	6
6/10	9/10	2	7/10	7/10	3
6/10	10/10	3	7/10	8/10	3
7/10	6/10	1	7/10	9/10	2
8/10	6/10	1	7/10	10/10	2
10/10	6/10	3	8/10	7/10	1
7/10	7/10	4	9/10	7/10	4
7/10	8/10	2	10/10	7/10	5
7/10	9/10	1	8/10	8/10	13
7/10	10/10	2	8/10	9/10	9
8/10	7/10	1	8/10	10/10	3
9/10	7/10	1	9/10	8/10	3
10/10	7/10	5	10/10	8/10	12
8/10	8/10	20	9/10	9/10	8
8/10	9/10	2	9/10	10/10	2
8/10	10/10	8	10/10	9/10	5
9/10	8/10	1			
10/10	8/10	20	Total for girls....		140
9/10	9/10	21			
9/10	10/10	5			
10/10	9/10	2			
Total for boys....		164			

Of the boys, 164, or 13 per cent of the total examined, suffered from impaired hearing which ranged from the total loss of hearing in one ear to the ability to hear at 9/10 of the normal distance in one ear. Among girls, 140, or 11.3 per cent of the total examined, suffered from impairment of hearing extending over the same range as in the case of boys.

In Table VIII is tabulated the defects of hearing found among all the children examined during this survey:

TABLE VIII.—*Auditory defects in 2,488 children attending the rural schools of Porter County.*

Defects.	Males.	Females.	Total.
Impairment of hearing in terms of tenths of the normal distance	164	140	304
Condition of ear drum:			
Adherent to promontory	2	3	5
Congested	4	6	10
Dull in one ear	19	18	37
Dull in both ears	64	63	127
Obscured by ceremum and scales, one ear [1]	37	48	85
Obscured by ceremum and scales, both ears [1]	25	33	58
Perforated in one ear	15	12	27
Perforated in both ears	6	5	11
Retracted in one ear	54	43	97
Retracted in both ears	74	55	129
Retracted and dull in one ear	24	11	35
Retracted and dull in both ears	63	27	90
Deafness	1	.....	1
Discharging ears	6	2	8
Eczema, external auditory canal	.....	1	1
External auditory canal closed, injury	.....	1	1
Otitis media, subacute	1	4	5
Otitis media, chronic	8	3	11
Total	567	475	1,042

[1] Associated with impaired hearing in 21 boys and 33 girls.

In this table it will be observed that 24 children were suffering from inflammation of the middle and discharging ears, conditions which require prompt treatment to avoid involvement of the mastoid cells. Furthermore, 27 children suffered from perforations of the eardrum of one ear and 11 children of both ears, indicative of a past prevalence of inflammation of the middle ear with its potential dangers to life.

Of more than passing interest was the presence of 21 boys and 33 girls with impaired hearing due to accumulations of ceremum (wax) and scales in one or both ears. The unsuspected existence of so large a number of cases of impaired hearing due to causes so easily remedied and their hampering effect on intellectual training emphasize the need and the value of making school inspections more emphatically than do defects of a more serious nature.

It will be observed that 30.9 per cent of the boys and 26.3 per cent of the girls examined presented some impairment of the eardrum, ranging from perforation to a slight dullness of one or both eardrums. In all cases of adherent eardrums, dullness, congestion, and retraction the underlying causes are either some involvement of the middle ear or of the Eustachian tube. A number of these conditions of the eardrum demand treatment at an early date for the removal of the underlying causes in order to prevent more serious impairment of hearing later in life.

NERVOUS SYSTEM.

But few cases of involvement of the nervous system were observed during this survey. Two boys, however, were suffering from paralysis of one side, the infantile cerebral type. Of the girls, one suffered from spastic paralysis of the infantile cerebral type, one from paralysis of both legs due to a previous attack of anterior poliomyelitis, and one from paralysis of one leg due to the same cause.

DEFECTS OF NOSE AND THROAT.

Adenoids.—Adenoids were present in 13.2 per cent of the boys and 9.8 per cent of the girls. In all the cases [illegible] the adenoids were developed to the extent requiring operative procedure.

Adenoids exercise a harmful effect on the physical and mental development of the child. Adenoid tissue, represented most conspicuously by the tonsils, is normally present in the upper and back part of the throat just behind the posterior openings of the nasal passages. Overdevelopment of this structure in this situation results from causes not well understood, but generally thought to be due to irritation induced by variations in temperature and humidity associated with poor ventilation. In time the free passage of air through the nose is restricted, mouth breathing supervenes, and the inspired air is not properly filtered, moistened, and warmed by contact with the nasal mucous membrane.

Neglect of adenoids and failure to secure their prompt removal when indicated is responsible for a train of unfortunate symptoms, is fraught with danger to life and is largely responsible for mental retardation and failure to make grade.

Diseased tonsils and [illegible] were observed in the throats of [illegible] boys and [illegible] girls, or over [illegible] per cent of all the children examined during this survey. [illegible] were observed with enlarged tonsils, in all cases in [illegible]—[illegible] boys and [illegible] girls, or over 10 per cent of the total examined.

Pharyngitis and [illegible]—Inflammation of the upper air passages represented by [illegible] and various grades of pharyngitis were observed in [illegible] boys and [illegible] girls, or 2.8 per cent of the total examined.

Deflections of the nasal septum and nasal spurs were encountered among 25 boys and 11 girls, or 2.8 per cent of the total examined.

Involvement of teeth.—Evidence of [illegible] was observed in 136 boys and [illegible] girls, or [illegible] per cent of all children examined. Not all of the [illegible] cases [illegible] were in need of immediate surgical attention, but [illegible] causes children to [illegible] operation for the removal of [illegible] because they are un-

larged. Tonsils in need of surgical attention were noted among 190 children, or 7.6 per cent of the total examined.

The tonsils readily become the seat of inflammatory processes, which are more or less chronic in character and which often extend to the middle ear, causing deafness. At times diseased tonsils are not enlarged but are embedded in the surrounding tissues, where they undergo slow suppuration followed by absorption of toxic substances injurious to health. In cases of this nature the offending organs should be removed.

DISEASES OF THE LUNGS.

The school children of the county were remarkably free from diseases of the lungs. Only two cases of tuberculosis were encountered during this survey, both of them being girls. A very low, general tuberculosis rate is reported by the State and county health officials in Porter County. As stated elsewhere, 74 children reported the occurrence of tuberculosis in the family, which represents a total prevalence during a number of years rather than the actual number of cases of this disease in existence in families of school children at the time of this survey.

In all, 2 boys and 10 girls were noted as being of a pretubercular type. This classification included children with nutrition below par, small chest expansion, development under the average, and apparently diminished powers of resistance.

The most frequent respiratory affection noted was a mild type of bronchitis, of which 15 cases were among boys and 17 among girls.

Bronchial asthma was diagnosed positively in only one instance. Several children, however, reported themselves suffering from this affection, the existence of which could not be confirmed by physical examination.

DISEASES OF THE SKIN.

Cutaneous diseases were not noticeably prevalent among the school children of the county. A few cases of eczema and impetigo were noted.

Ringworm of the face was observed in 2 boys and 3 girls, and ringworm of the scalp in 2 boys and 1 girl. Ringworm of the scalp is remarkably resistant to treatment. This disease is transmissible, is loathsome in appearance, and causes baldness. For this reason cases of ringworm should be excluded from school under treatment.

DEFECTS OF THE TEETH.

A total of 2,451 children were examined during this survey for dental defects, 1,236 boys and 1,215 girls. Of this number, 479 boys and 637 girls, 60 per cent of the former and 50 per cent of the latter, had some form of dental defects.

Of the boys, 54.5 per cent had 2 or more defective teeth, and of the girls, 44.2 per cent. The highest percentages of defective teeth were observed among boys from the fifth to the eleventh year and among girls from the fifth to the tenth year. The reduction in the number of defective teeth during the following age periods was steady in the case of girls, but more irregular among the boys.

The highest percentages of children with two or more teeth missing were encountered between the fifth and eleventh years among the boys and the fifth and ninth years among the girls, ranging from 28 per cent in the fifth year and 45.5 per cent in the eighth year to 28.2 per cent in the eleventh year. The per cent of the girls with two or more missing teeth ranged from 25.8 per cent during the fifth year, 37.5 per cent in the seventh year, and 26.7 per cent in the ninth year. It will be observed, therefore, that the highest percentages of defective and missing teeth were encountered during the period of the deciduous teeth. The general average for boys was 23.4 and for girls 18.9.

Malocclusion.—This was observed in marked degree, with equal frequency in boys and girls, in 4.8 per cent of those examined.

Dental work.—The extent to which dental correction had been practiced was slight up to the eighth year. From this age period the percentage of dental work increased appreciably and in greater relative proportion among the girls for corresponding age periods. Of 20 boys and 28 girls at 17 years of age, 45 per cent of the boys and 71.5 per cent of the girls had had some form of dental work. The general average for boys was 14.1 and for girls 19.7.

Toothbrush.—The use of the toothbrush by boys and girls presents some interesting comparisons. In all, 1,039 boys and 1,020 girls were classified with respect to the use of the toothbrush according to age periods, whether daily, occasionally, or never. Of the total, 18.3 per cent of the boys and 10.5 per cent of the girls never used a toothbrush at all, 67.8 per cent of the boys and 48.6 per cent of the girls used the toothbrush occasionally, and the daily use of the toothbrush was noted in but 13.9 per cent of the boys and in 40.9 per cent of the girls.

The greatest number of children never using the toothbrush was encountered between the fifth to the ninth year age periods, boys in greater number than the girls. The daily and occasional use of the toothbrush increased with more advanced age among the boys, but among the girls the number using the toothbrush occasionally decreased, while that of those using it daily increased. In other words, 70 per cent of the girls at 6 years of age used the toothbrush occasionally, and 94 per cent of them used it daily at the eighteenth year.

Oral hygiene.—The results of these examinations show the necessity of greater care of children's teeth in rural communities. Especially is this true of deciduous, the so-called "milk" or temporary teeth. These should be preserved as long as possible. When the temporary teeth are lost too early or at too long an interval before the eruption of the permanent teeth, shortening of the jaw takes place, and the permanent teeth erupt in an irregular manner.

The child should therefore be trained in the use of the toothbrush at an early age.[1]

The undue number of children who never used the toothbrush, as revealed by these examinations, the still greater number who used it only occasionally, and the failure to provide for dental service in the case of the younger children call for greater attention on the part of the parents for the protection of the physical and mental fitness of their offspring.

SPEECH DEFECTS.

Two general types of speech defects are met with in school inspection. In one class the children are without full control of the nerve mechanism of speech, a type represented by children who stammer. In the second class are those unable to articulate clearly because of some defect or deformity. Defective speech, when marked, prevents children from taking advantage of educational opportunity and, furthermore, in later life, renders it difficult for them to secure desirable positions.

Except in populous districts where the total number of children so afflicted is proportionately great, the special teaching measures devised for these defects are not available for school purposes.

In the course of this survey 8 boys and 6 girls with speech defects were encountered. The defect in the main was some form of stammering.

SPINAL CURVATURE AND FAULTY POSTURE.

Deviations of the spinal column from the normal are either functional or organic in character. In the latter the defect is usually due to past or present involvement of the bony structure in some disease process.

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[1] Certain rules for the preservation of the teeth recommended by the British Dental Association are as follows:

1. The teeth should be cleaned at least once daily.
2. The best time to clean the teeth is after the last meal.
3. A small toothbrush should be used, brushing up and down and across, inside and outside, and between the teeth.
4. A simple tooth powder or a little soap and some precipitated chalk taken up on the brush may be used if the teeth are dirty or stained.
5. It is a good practice to rinse the mouth out after every meal.
6. The rough use of the teeth, such as cracking nuts, biting thread, etc., should be avoided, but the proper use of the teeth in chewing is good for them.

The number of cases of spinal curvature due to organic lesions encountered during this survey was not large, there being but 2 boys and 2 girls so afflicted. Of the so-called functional spinal curvatures, however, 25 were among boys and 11 among girls, largely of the lateral type.

The most noticeable defect associated with faulty posture among school children is some form of functional spinal curvature.

It is doubtful, however, if the school can be considered the most prominent factor in the production of spinal curvature. The principal and underlying cause of this defect is a weakened and relaxed musculature. This results in a tendency to assume slouching attitudes which has usually been contracted by the child before entering school.

Effects of faulty posture on vision.—The relatively short anterio-posterior diameter of the eyes of very young children renders it difficult for them to see near objects without great efforts of accommodation, during which the ocular muscles become fatigued. The assumption of postures which bring the work nearer the eyes of young children therefore sets up a vicious train, the fatigue induced causing straining of accommodation, and still greater bending of the head to secure a clearer image by this closer approximation.

Other effects of faulty posture.—The habitual assumption of an incorrect posture with bended back and drooping shoulders causes contraction of the chest, incomplete expansion of the lungs, and reduced aeration of the blood. The full nutritive value of the food supply is not utilized and children so hampered are usually anemic, flabby, and improperly developed.

Although the school can not rightly be considered responsible for the tendency of children to assume faulty postures, it does crystallize, as it were, permanent faulty postural habits, unless measures be taken to overcome them. The installation of well-devised desks and their frequent adjustment to the needs of children insure the assumption of an upright position by placing the school work at a comfortable and convenient distance from the eyes. Children who display a tendency to faulty postures may and should have the muscle sense developed by appropriate regulated exercises. It must be remembered, however, that slouching attitudes are due to relaxation of easily fatigued muscles. Children of this type, therefore, require more frequent intervals of rest from positions of restraint than the normal child.

HERNIA.

Loss of tone by the abdominal muscles, caused by faulty postures, doubtless is responsible in a number of instances for the incidence of hernia. Hernias encountered among young children, however,

are usually congenital in type, the genesis of which has no connection with habitual positions assumed by the child. Because of the restriction of physical examinations of this character in school work, the incidence of hernia among the school children of the county was considered from the standpoint of boys only. Among these, there were observed 5 cases of hernia, 4 of which were of the inguinal type and 1 umbilical.

DEFECTS OF VISION.

The association of two or more visual defects in the same subject was quite frequently observed during this survey. Including the errors of refraction, 1,335 visual defects were distributed among 1,142 children, or not quite 1.2 defects for each child examined. Visual defects were present in 45.9 per cent of the total children examined. The greatest number of visual disturbances encountered during this survey were due to errors of refraction which are tabulated in Table IX:

TABLE IX.—*Snellen chart visual test readings in 169 cases of faulty refraction.*

Boys.			Girls.		
Right vision.	Left vision.	Number.	Right vision.	Left vision.	Number.
20/200	20/200	4	20/200	20/200	9
20/200	20/70	1	20/200	20/30	3
20/140	20/200	1	20/140	20/140	3
20/50	20/200	1	20/70	20/200	1
20/30	20/200	1	20/30	20/200	1
20/100	20/100	4	0/0	20/200	1
20/100	20/20	1	20/100	20/100	4
20/100	20/30	1	20/100	20/30	1
20/100	20/40	1	20/100	20/40	1
20/20	20/100	1	20/80	20/100	1
20/70	20/70	6	20/70	20/100	2
20/70	20/20	1	20/80	20/80	2
20/50	20/50	7	20/70	20/70	4
20/50	20/30	4	20/70	20/50	2
20/50	20/20	1	20/70	20/30	1
20/40	20/50	3	20/50	20/70	1
20/30	20/50	2	20/40	20/70	1
20/40	20/40	12	20/50	20/50	10
20/40	20/30	4	20/50	20/40	3
20/40	20/20	1	20/50	20/30	5
20/40	0/0	1	20/50	20/20	1
20/30	20/40	8	20/40	20/50	4
20/20	20/40	1	20/30	20/50	1
			20/20	20/50	1
			20/40	20/40	14
			20/40	20/30	10
			20/40	20/20	2
			20/30	20/40	12
			20/20	20/40	1
Total for boys..		67	Total for girls...		102

Only marked refractive errors were recorded in the table, errors which require correction by glasses. Of these there were 169 cases, 67 boys and 102 girls, or 5.3 per cent of the former and 8.2 per cent

of the latter, among the total examined. It would seem, therefore, that refractive errors are almost twice as common among girls as among boys. Correction by glasses had been attempted in 33 instances, or in 19.2 per cent of those suffering from marked refractive errors.

The specific visual defects are recorded in the following table:

TABLE X.—*Defects of vision in 2,488 children attending the rural schools of Porter County, Ind.*

Visual defects.	Males.	Females.	Total.
Absorption of lens with opaque capsule, right	0	1	1
Anemia (nerve head), left	3	3	6
Astigmatism:			
Against the rule, both eyes	75	63	138
Against the rule, left eye only	45	51	96
Against the rule, right eye only	37	50	87
Against the rule, right, with the rule left eye	30	34	64
With the rule, both eyes	139	111	250
With the rule, left eye only	62	57	119
With the rule, right eye only	60	59	119
With the rule, right, against the rule left eye	46	33	79
Mixed	0	1	1
Atrophy, tissues of orbit	1	0	1
Blepharitis	28	45	73
Blind, one eye:			
Right	1	4	5
Left	1	0	1
Choroid, pathological accumulation of pigment	1	0	1
Choroid, thinned	0	1	1
Coloboma of choroid and iris, left	1	0	1
Congestion of nerve head, left	0	1	1
Conus:			
Infratraction	2	2	4
Supratraction	1	3	4
Defective color sense	26	3	29
Exophoria	3	1	4
Hordeolum	2	4	6
Hyperopia, marked	10	12	22
Iris, adherent, central leucoma	0	1	1
Myopia:			
Marked	4	15	19
Right eye, hyperopia, left eye	0	1	1
Nebulae with defective vision	0	3	3
Nystagmus, spontaneous	3	2	5
Polycoria, left	1	0	1
Opacity, both lenses, congenital	0	1	1
Strabismus:			
External	1	0	1
Internal	8	6	14
Trachoma	5	2	7
Vision uncorrected, 20/200 to 20/40 in one or both eyes	67	102	169
Total	663	672	1,335

Astigmatism.—Astigmatism was present in one or both eyes among 953 children, or 38.3 per cent of the total. With regard to sex, 39.4 per cent of the boys and 36.3 per cent of the girls were astigmatic.

Hyperopia.—Hyperopia was determined by the ophthalmoscope and only marked cases of this refractive error were recorded because the eyes of young children are normally hyperopic. Twenty-two cases of hyperopia were recorded, 10 of them in boys and 12 in girls.

Myopia.—This was likewise determined by the opthalmoscope and the marked cases only were recorded. Of these, there were noted

19 cases, 4 in boys and 15 in girls. It is seen from the foregoing observations that refractive errors of all types were encountered among girls in larger proportion than among boys.

Extreme types of myopia are found associated with poor school environment more frequently, probably, than any other form of grave refractive error. The influence of marked myopia upon the future possibilities of the child is very pronounced, limiting to a noticeable degree the occupations in which he can engage.

In schools he should be protected from glare and undue brightness and provided with a desk of such a type that the work may be placed at the most suitable angle and distance for visual comfort. Although there may be doubt that faulty position and poor illumination and posture are causative factors of myopia, still it is well recognized that these conditions may intensify the degree of myopia originally present.

Defective color sense.—This was noted in the case of 29 children, 26 of these being boys and 3 girls. The inability to distinguish colors limits the number of occupations in which boys so afflicted may profitably engage. This is especially true in railroading, navigation, and in the manufacture of certain textiles. It is a singular fact that a number of people with faulty color sense are unaware of this defect. The determination of this fault at an early age, therefore, may be of value in directing the activities of the child to fit him for occupations in which the possession of the normal color sense is not a matter of such great importance.

Trachoma.—Trachoma is a contagious disease of the eyes potentially dangerous to vision. This disease is now known to be more widely prevalent in this country than was formerly thought to be the case. Unfortunately mild types of trachoma may exist without producing noticeable symptoms for long periods, yet eyes in this condition are potentially infectious to others. The necessity for the inspection of the eyes of school children for the detection of cases of trachoma is therefore apparent.

In the course of this survey but 7 cases of trachoma were encountered, 5 among boys and 2 among girls. The slight prevalence of trachoma in Porter County, Ind., as indicated by these figures, is an evidence of the care exercised in the inspections for this disease at the ports of entry, because a considerable proportion of the population of this county is drawn from sections of Europe in which trachoma prevails extensively.

GOITER.

Simple thyroid enlargement, commonly called goiter, is more or less prevalent in practically all localities. This condition, however, has been found unduly prevalent in regions underlaid by ancient

limestone formations. The actual cause of goiter has not yet been determined, though by many it is thought to be due to the drinking of unduly hard waters. While the presence of simple thyroid enlargement is not particularly harmful, nevertheless from the esthetic standpoint its correction is highly desirable.

Records were made, therefore, of the prevalence of this defect among the school children of the county and classified according to whether the enlargement was pronounced or only slightly noticeable. Among the 2,488 children examined, 872 girls and 648 boys, or 61 per cent of the total examined, presented some degree of thyroid enlargement. Of the 1,235 girls examined, 43.4 per cent presented noticeable thyroid enlargement, and in 24.3 per cent it was only slightly so. Of the 1,253 boys examined, 26.7 per cent presented noticeable thyroid enlargement and in 27.6 per cent the enlargement was slight. The distribution of goiter in this county is remarkable in that this gland is involved in such a high percentage of the boys examined, in marked contrast to the observations of one of the writers (Dr. Clark) in other localities.

PART III.

MENTAL STATUS OF RURAL SCHOOL CHILDREN OF PORTER COUNTY.

In the course of this survey, a study was made of the mental condition of each child. The purpose was not only to determine the number of mental defectives which require special or individual treatment, but to study the influence of school surroundings on mental status. Coincidently, studies were made to determine the value of the Binet-Simon tests for grading intelligence.

A total of 2,185 children were thus examined, special reliance being placed in the Binet tests with some modifications. In the case of exceptionally retarded children revealed by these tests, however, special methods were employed to determine the degree of mental impairment.

HISTORY OF THE TESTS.

As is known, Binet and Simon, on data collected during the examination of 200 normal French school children, devised a series of tests for different age periods. As originally devised, the number of tests for each age group varied from four to seven. In 1911, the tests were revised and the number for each age group was fixed at five, except that of the four-year group, which contains four tests. This revision was based on the examination of 203 French school children. Of this number, the observers gave tabular results for 192, as follows:

TABLE XI.—*Mental and chronological ages of 192 French school children examined by Binet and Simon.*[1]

Chronological age.	3	4	5	6	7	8	9	10	11	12	Total.
Regular	3	9	13	5	7	16	11	14	13	2	93
Advanced 1 year	3	2	6	8	7	5	9	2	....	....	42
Advanced 2 years	....	1	....	....	....	1	....	....	....	....	2
Retarded 1 year	4	4	4	6	3	1	2	9	5	5	43
Retarded 2 years	....	1	....	1	1	....	....	3	2	4	12
Total	10	17	23	20	18	23	22	28	20	11	192

[1] In this classification, "regular" signifies that the child's mental age is the same as the chronological age. Advanced and retarded are self-explanatory.

It will be observed in the above table that nearly half the children were regarded as regular, while those retarded and those advanced one year were about equal in number. Only 14 of the 192 showed a departure from the regular of more than one year.

These tests were the first of this character devised for the purpose of determining the degree of intelligence of children in terms of mental ages. By reason of their simplicity they became widely popular.

The tests have been objected to by some on the ground that they are mainly tests of the intelligence. They certainly do not aim at a systematic determination of the development of any particular mental function. They have been found, however, in an empirical way to give results which show the general mental development of the child.

The Binet-Simon tests do not extend beyond the chronological age of 12, because, following this age period, the mental content becomes more intricate, and a small number of tests at any subsequent age would be far from accurate.

Because of the objection that Binet and Simon examined too small a number of children to establish norms, Goddard determined the norms for these tests in the case of 2,000 American school children. His results in the case of 1,532 children are given in the following table:

TABLE XII.—*Mental and chronological ages of 1,532 American school children examined by Goddard.*

Chronological age.	Mental age.												
	2	3	4	5	6	7	8	9	10	11	12	13	Total.
4	....	1	2	2	3	....	....	....	....	....	....	....	8
5	2	4	8	40	40	16	4	....	....	....	....	....	114
6	1	....	3	29	48	69	9	....	1	....	....	....	160
7	....	1	2	8	15	14	50	4	3	....	....	....	197
8	....	....	2	2	1	87	86	16	12	3	....	....	209
9	....	....	....	....	....	27	54	56	58	4	2	....	201
10	....	....	....	....	....	15	24	19	124	27	8	2	219
11	....	....	....	....	....	4	13	25	50	60	12	1	165
12	....	....	....	....	....	4	10	13	42	36	39	7	151
13	....	....	....	....	....	1	5	6	30	19	21	3	85
14	....	....	....	....	....	....	1	1	6	5	4	....	17
15	....	....	....	....	....	....	....	3	....	1	2	....	6
Total	3	6	17	81	107	337	256	143	326	155	88	13	1,532

It will be observed in the above table that up to the age of 9 nearly all of the children of each age group graded either regular, one year advanced or one year retarded. In the succeeding age groups, nearly all of them graded either regular, one year advanced or two years retarded with the exception of the 10-year-age group, in which nearly as many children graded three years retarded as were retarded only one year.

METHOD OF EXAMINATION AND GRADING.

Goddard's revision of the Binet-Simon scale, with the addition of his 15-year old and adult test groups, was used in this survey. In one-room schools the children were examined in the classroom, in schools of more than one room in a room where physical examinations were being made. In other words, the examination was not made in a quiet place, but in one that represented in part the child's daily schoolroom environment.

The following method of grading was employed: The child was given a basal mental age corresponding to the age group in which he successfully passed all the tests, and to this one year was added for each five tests passed successfully in the higher age groups. For example, if in addition to all the 8-year tests he also passed 3 in the 9-year group and 2 in the 10-year group, he was graded as having a mental age of 9 years.

In the case of the 12-year-old group, however, in view of the inability of a large number of 12-year-old children to repeat a sentence of 24 syllables, a child successfully passing all five of these tests and one of the 15-year group was classed as 13 mentally.

Children were classed as 15 years old mentally when they passed all of the 15-year-old tests but less than half of the adult tests, and as adults when they passed 75 per cent of the adult tests.

Statistical results of the application of the Binet-Simon tests to 2,185 rural school children of Porter County in the first to eighth grades inclusive, are given in the following table:[1]

RESULTS OF MENTAL EXAMINATION.

TABLE XIII.—*Chronological and mental ages of 2,185 children attending the rural schools of Porter County, Ind., in terms of per cent.*

Chronological age.	Mental age in terms of per cent of the total in each age group.												Total examined.
	4	5	6	7	8	9	10	11	12	13	15	A.	
5	.....	**23 +**	42.25	23 +	11.5+	.....	.....	.....	.....	.....	.....	.....	26
6	2.8	18.7	**27.+**	33.7	16.8	.....	0.93	.....	.....	.....	.....	.....	107
7	.43	5.6	23.7	**37.9**	25.8	5.2	8.6	.....	0.43	.....	.....	.....	232
8	.42	1.7	6.0	12	**44.5**	18.8	6.4	2.1	.....	.....	.....	.....	234
9	.92	.92	3.7	6.5	29.1	**31.4**	22.7	4.1	.46	.....	.....	.....	216
10	.....	.36	.72	2.5	16.3	23.7	**40.7**	12.9	2.5	0.36	.....	.....	278
11	.....	.....	.....	1.8	6.6	9.9	35.3	**35.3**	8.9	1.8	.....	.....	212
12	.....	.....	.....	.....	2.6	10.3	21.0	37.8	**22.2**	5.7	0.82	.....	243
13	.....	.....	.....	.4	2.4	5.6	19.5	35.8	20.1	**13.6**	2.8	.....	249
14	.....	.....	.....	.55	.55	4.9	7.7	28.7	24.3	21.5	11.6	.....	181
15	.....	.....	.....	.....	2.9	11.7	8.8	14.7	13.4	19 +	**28 +**	1.4	136
16	.....	.....	.....	.....	.....	7+	10.5+	15.8+	22.8+	14 +	28 +	1.7+	57
17	.....	.....	.....	.....	9 +	9 +	9.0+	18.2	18.2	9 +	18.2	9 +	11
18	.....	.....	.....	.....	.....	.....	.....	50	50	.....	.....	.....	2
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.	.....	.....	1
Total	7	46	119	204	324	280	387	390	210	128	86	4	2,185

[1] In this tabulation a child was recorded as having the chronological age of his nearest birthday and likewise as having the nearest mental age (when grading mentally in fractions of a year.

LIMITS OF NORMALITY.

A glance at the foregoing tables of Binet-Simon and Goddard will show that large numbers of normal children, chronologically 6, 7, 8, and 9 years of age, graded either regular, one year advanced, or one year retarded. In the case of children 10, 11, and 12 years old, chronologically, large numbers graded either regular, one year advanced, or one or two years retarded.

In the case of 13-year-old children, however, those retarded as much as three years are regarded as normal, because nearly all of the children of the series come within these limits. Thirteen-year-old children who grade 15, however, must be regarded as "exceptional children." The 14, 15, and 16 year old children graded largely within the limits of 11 and 15 years mentally and those of 17 to 20 years of age from 12 to adult.

CLASSIFICATION OF RETARDED AND EXCEPTIONALLY RETARDED CHILDREN.

The mental progress of a child is rapid for the first few years of its life but becomes slower as maturity is approached. There is, as yet, no means of measuring this rate of progress. The difference in the mental development of a normal 2-year-old child and one 3 years old is readily recognized. This difference becomes difficult to note between the ages of 6 and 7, and between 11 and 12 years of age the recognition of mental difference by ordinary observation is quite impossible.

Mental development during any one-year period does not represent accurately a unit of mental growth, because the older the child the less rapid is the rate of mental development and the less noticeable is the retardation in any one year age period.

Moreover, retardation in very young children presents two possibilities. In the first place, owing to the greater number of years intervening before maturity, these children eventually may attain normal mental development. On the other hand, retardation may accumulate and become increasingly evident with advancing age. In consequence, the ultimate mental development of young children thus classified can not be foretold.

The problem is not so complex, however, in the case of adults or individuals who have reached a chronological age at which the rate of mental development is slower. Retardation below a certain point can not be overcome in the short time intervening before maturity at the slower rate of development, and the mental status in these cases may be determined with certainty.

The classification used in this report is based on the above considerations and children are recorded as retarded and exceptionally

retarded. With the former the possibility remains of ultimate normal mental development, while with the latter the mental development will never be greater than that of a child when adult age is reached.

A graphic representation of the classification employed in these studies is shown in chart 10. Reference to it will show that children of 6 years who were 4 mentally, of 7 who were 5, of 8 who were 5 or 6, of 9 who were 6 or 7, of 10 who were 6 or 7, of 11 who were 7 or 8, of 12 or 13 who were 8 or 9, of 14 or 15 who were 9 or 10, of 16 who were 10, of 17 to 20 who were 11, are classified as exceptionally retarded.

The method of classification used is considered conservative. Although this classification may not include all the mental defectives in a school population, because of the inability to determine positively subnormality in the very young children of the lower grades, and who must, therefore, be regarded as retarded only, still the method is more reliable than the arbitrary grading children as defectives who are retarded as much as three years. The adoption of the latter procedure would have recorded a percentage of feeble mindedness for this county far in excess of actual conditions.

RETARDED CHILDREN.

Retarded children are to be found in every large school system. It has been stated that 50 in every 1,000 public school children have difficulty in keeping up with their work and are in need of individual assistance.

Of the 1,087 girls and 1,098 boys examined in the rural schools of Porter County, 93 of the former and 100 of the latter were retarded, and excluding the exceptionally retarded children, constituted 8.7 per cent of the number examined. Including the exceptionally retarded children, the whole number of children requiring special attention was 214 or 9.3 per cent.

DEFECTS ASSOCIATED WITH RETARDATION.

The delicate physical and mental adjustments of children are much more easily upset than is the case with adults. Minor physical defects which ordinarily make no impression upon a grown person may prevent the normal physical and mental growth of the child. Defects of vision and hearing, defective teeth, adenoids, enlarged tonsils, nutritional disturbances, and certain general diseases react injuriously on both the physical and mental development of the child. It becomes important, therefore, to consider the hampering effects of physical defects and diseases in connection with mental retardation, and to take steps for their correction when possible.

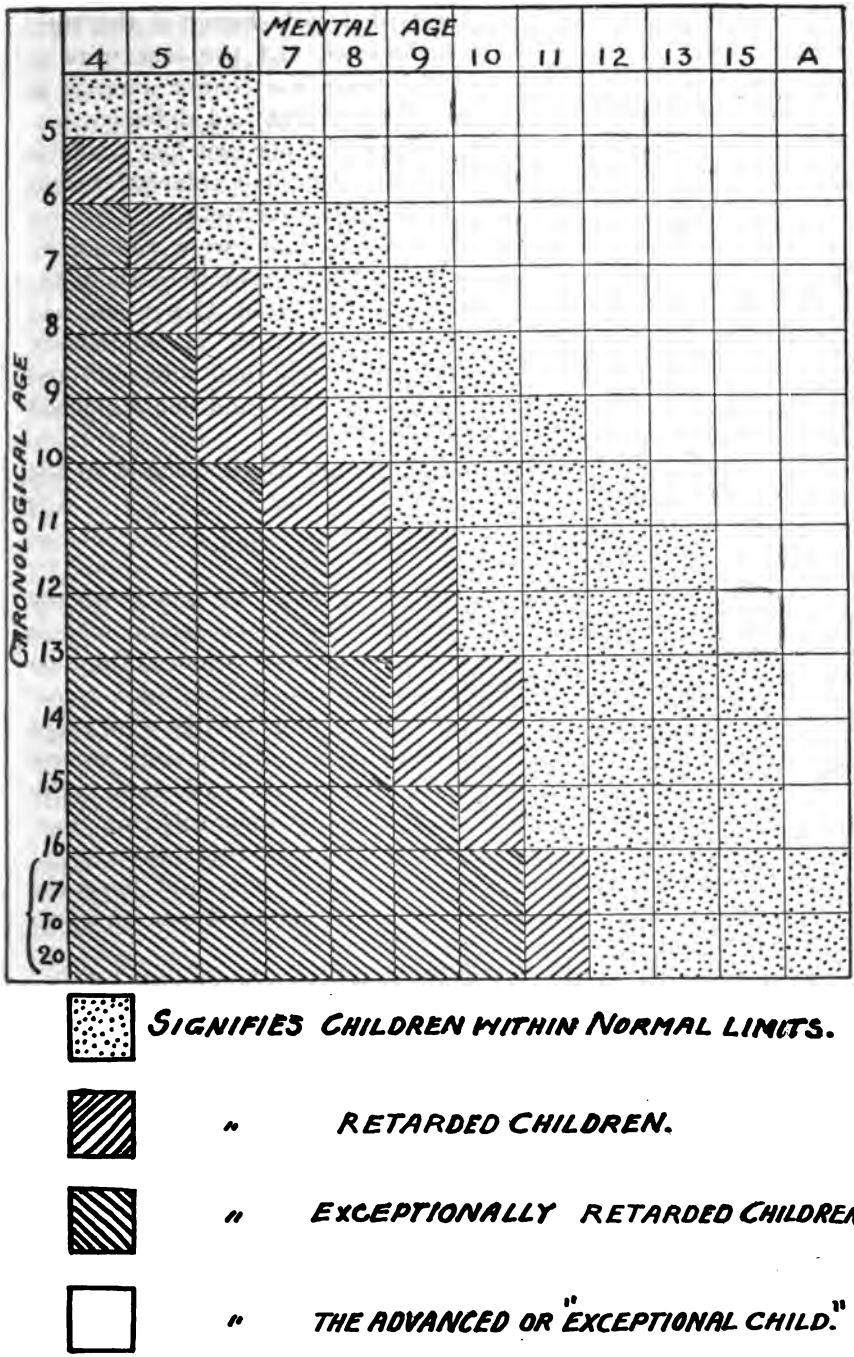

CHART 10.—Normal mental age limits for one-year chronological age periods, and limits for advanced, retarded, and exceptionally retarded children, measured by Binet-Simon scale.

Thirty-five per cent of the 93 retarded girls found in the rural schools of Porter County were undersized, 41.1 per cent were of normal size, and 23.5 per cent were above the county average in height and weight. Furthermore, 58.8 per cent had defective eyesight, 26.4 per cent had defective hearing, 1.7 per cent had adenoids associated with enlarged tonsils, 2.9 per cent had enlarged tonsils without adenoids, and 17.6 per cent had defective teeth.

Thirty-eight per cent of the 100 retarded boys were undersized, 30 per cent were of normal stature, and 32 per cent were above the county average of height and weight. In addition, 47 per cent had defective eyesight, 19 per cent had confused color discrimination, 34 per cent had defective hearing, 6 per cent had adenoids and enlarged tonsils, 17 per cent had defective teeth, and one child had a cleft palate.

Two or more physical defects were frequently associated in the same child.

OTHER CAUSES OF MENTAL RETARDATION.

Improper teaching methods are responsible for much of the retardation found in schools. The teachers of the public schools of the country have imposed upon them a great responsibility, no small part of which is the molding of character. Education is something more than imparting instruction. Young people who adopt teaching as a temporary avocation do not meet with the same success in training children as do those who make this profession a life work. The training of teachers, therefore, and their selection, warrants the most careful consideration, because, in addition to technical training, the successful teacher must be adaptable and have the ability to broaden the outlook upon life of certain types of introspective children.

Poorly equipped school buildings, defective illumination, faulty ventilation and heating, uncomfortable seats and unattractive surroundings operate to cause retardation. The discomfort experienced in buildings of this type produces a hampering effect on the mental concentration necessary for educational purposes. The provision of school buildings erected in accordance with modern sanitary principles will do much to reduce the amount of retardation appearing in school children.

In a number of instances, children have been advanced in grade without proper preparation. A child who has failed to acquire the fundamentals in a lower grade can not properly do the work in the higher classes and, when unduly promoted, suffers injurious retardation. Children of this type frequently quit school with a poor educational equipment.

In Porter County the average loss of grade by retarded children, as recorded by teachers, was 1.28 years for girls and 1.5 years for boys.

Mental retardation is most frequently met with in crowded one-room schools where several grades are taught by one teacher. A number of schools of this type are in operation in Porter County. Where the number of pupils in attendance is large, the time of the teacher is too occupied by routine duties to permit of individual instruction of children who find difficulty in mastering the fundamentals of education.

CARE OF RETARDED CHILDREN.

Children who are unable to advance in school work by methods which are effective in regular classes require special educational facilities, which are of practical attainment through the organization of special classes. The organization of such classes rarely can be accomplished in districts where there are principally one-room schools by reason of the increased cost. The consolidation of rural schools, however, offers facilities for special classes and individual instruction to larger groups of children, who would otherwise remain misfits in the smaller schools.

Wherever such classes are organized, the retarded children should not be segregated in the most undesirable room in the building. Moreover, the teachers should have special qualifications for this kind of instruction and not be selected because of years of experience in other branches of pedagogy. They should have training in the management of children, a knowledge of the methods employed in correcting speech defects, and a fair understanding of some of the problems of psychology as related to the child and of the principles of physiology.

The value of special classes for retarded children is shown by the fact that 50 per cent of the children who are placed in such classes rejoin their proper grade when faulty methods are corrected and physical conditions improved.

EXCEPTIONALLY RETARDED CHILDREN.

Of the 1,087 girls and 1,098 boys examined in the rural schools of Porter County, 7 or 0.6 per cent of the former, and 14 or 1.2 per cent of the latter were so exceptionally retarded that their mental development at no time will be greater than that of a child.

DEFECTS ASSOCIATED WITH EXCEPTIONAL RETARDATION.

Twenty-eight per cent of the exceptionally retarded girls were undersized and 57 per cent were above the average physical development of the county, as compared with only 23.5 per cent of the girls

who were simply retarded. Furthermore, 42.8 per cent had defective eyesight, 14.2 per cent had defective hearing, and 2.9 per cent had enlarged tonsils.

Of the exceptionally retarded boys, 28.5 per cent were undersized, 28.5 per cent were of normal physical development, and 42.8 per cent were above the average for the county in height and weight. In addition, 34.2 per cent had defective eyesight, 57.1 per cent had defective hearing, and 7.1 per cent had enlarged tonsils.

Among the exceptionally retarded children the average loss of grade, as recorded by teachers, was 2.1 years for girls and 2.5 years for boys.

The number of exceptionally retarded children constituted 0.9 per cent of the total number examined. This does not include all of the defectives among children of school age in the county. It must be assumed that some children, by reason of grave mental defects, were unable to attend school.

CHARACTERISTICS OF EXCEPTIONAL RETARDATION.

Mental deficiency, or feeble-mindedness, as it is more often termed, has been defined as a lack of normal mental development. Individuals of this class can be educated to a degree, but with them mental progress is so decidedly slow that their mental capacity is no greater than that of a child, even when adult life is reached. Persons whose intelligence is developed to so slight a degree are misfits in a society arranged for people whose mental development continues until the retrogressive changes of old age begin. They become dependents because of their inability to compete with persons of higher intelligence, immoral because unable to adjust their sexual problems to moral laws, and delinquent because they do not understand the significance of laws devised for the protection of society.

CAUSES OF EXCEPTIONAL RETARDATION.

A defective heredity, insanity, alcoholism, and syphilis in one or both parents are considered responsible for most of the cases of mental defectives. A large part of the evidence that heredity is an important causative factor of mental deficiency is based on indirect testimony. The great value of investigations of this character is the determination of existing cases of mental deficiency as a starting point for future studies of the influences of heredity on succeeding generations.

Of the other causes of mental deficiency may be mentioned congenital defects, injuries, and nutritional disturbances. Improvement by better sanitation of the health of communities will be followed also by a reduction in the number of mental defectives.

NUMBER OF EXCEPTIONALLY RETARDED CHILDREN.

According to the United States census report, 1910, 20,000 mental defectives were in special institutions in this country. Mental examinations of a large number of persons in prisons, penitentiaries, jails, and workhouses during the last few years show at least a third of the number examined to be mentally defective. At this rate not less than 40,000 of the 136,472 persons in such institutions, including those for juvenile delinquents, in 1910 were mental defectives.

It has been estimated that 20 in each 1,000 American school children are mental defectives,[1] and that 2 in 1,000 of the general population are mental defectives. On the basis of the lowest figures it is estimated there are at least 200,000 feeble-minded persons in the United States. As a conservative estimate, about 130,000 feeble-minded persons are without institutional care of any description. Only 26 States have provided institutions for the feeble-minded.

CARE OF MENTAL DEFECTIVES IN INDIANA.

In 1879 a department for feeble-minded children was established as an adjunct to the Soldiers' and Sailors' Orphans' Home at Knightstown, Ind. The legislature, by an act approved March 7, 1887, gave the institution an independent existence and changed the name to Indiana School for Feeble-Minded Youth. A new institution was built at Fort Wayne. It was not occupied, however, until July 8, 1890.

The privileges of the school are extended to feeble-minded, idiotic, epileptic, and paralytic children under 16 years of age. Since 1901 the school has maintained a custodial department for feeble-minded women between the ages of 16 and 45 years. These women are committed by the courts (Laws, 1887, p. 47; 1901, p. 156). A colony farm containing 509⅓ acres has been in operation since 1893.

The superintendent of the various almshouses in Indiana, in 1914, reported 489 feeble-minded men and 380 feeble-minded women in the various almshouses of the State. Of the 380 feeble-minded women, 118 were within the child-bearing age period. Of the 3,228 almshouse inmates, 1,389, or 43 per cent, were insane, feeble-minded, or epileptic.[2]

EDUCATION OF FEEBLE-MINDED.

The aim of the education of feeble-minded children should be to train them to be self-supporting. Intellectual training, in its narrower sense, is of secondary importance.

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[1] The number of mental defectives found in this survey are not greater than 9 in 1,000.
[2] Twenty-fifth Annual Report of the Board of Charities of Indiana, September, 1914.

Most American institutions for the feeble-minded are broadly divided into two departments—educational and custodial. The education of the feeble-minded, compared to that for normal children, differs in degree only and begins at a lower plane. Satisfactory gradations or classifications are made so that children with irregular and unusual deficiencies receive individual training in special classes.

The most prominent feature of the education of the feeble-minded, however, is their training in industrial occupations and manual labor, as now successfully and profitably carried on by the pupils in these schools. Through correct training of this character a certain number of these individuals lead useful lives after leaving the institutions. About one-half the higher grades of mental defectives who have been under training from childhood are self-supporting, under intelligent supervision, whether in an institution or at home. It is especially important to begin training of this character early in the child's life.

MENTAL DEFICIENCY AND ITS RELATION TO THE COMMUNITY.

Recent investigations of the defective and delinquent classes have demonstrated that a large percentage of criminals, paupers, tramps, and prostitutes are really congentital imbeciles who have been allowed to grow up without training or discipline. Society suffers the penalty of such neglect through an increase in pauperism, vice, and crime, and the greatly increased cost of the care of adult feeble-minded persons.

Feeble-minded girls, exposed to evil influences, are unable to protect themselves from the perils peculiar to women. There is hardly a poorhouse in this country which has not one or more feeble-minded women who are mothers of several illegitimate children. It is often the case, in rural communities, that a girl of this type, when illegitimately pregnant, has no place to go except to the almshouse. After the community has borne the expense of three or four confinements, she is finally committed to an institution for the feeble-minded. From every consideration of morality, humanity, and public policy, feeble-minded women should be under permanent and watchful guardianship, especially during the child-bearing age.

OTHER MENTAL CONDITIONS WHICH REQUIRE SUPERVISION.

EPILEPTICS.

During the course of this survey three epileptic children were observed. One of these was feeble-minded.

The State of Indiana has provided an institution for cases of this type, which is located near New Castle. All epileptics having a legal settlement in the State are admissible.

Recent studies of juvenile offenders show that a fair per cent of them are afflicted with epilepsy. It is estimated that every juvenile epileptic offender, because of his constitutional tendency to corrupt others, in the end will cost the State the sum of $6,000. It is important, therefore, for communities to realize that, because mental conditions play no small part in the production of crime, early recognition of these cases and suitable provisions for their supervision and training will obviate future expense.

JUVENILE DELINQUENT.

In every community there is a number of children who are morally irresponsible. They showed no marked deficiency of the intellectual faculties, but early in childhood manifest a perversion of the moral sense, which is shown by motiveless, persistent lying and thieving, an impulse to arson and cruelty to animals and to younger or helpless companions. These constitutionally inferior persons comprise a large percentage of habitual criminals. The presence of one or more children of this type in school exercises a pernicious influence that is usually associated with an increase in the number of children who fail to make grade. It is undesirable to permit children of this type to attend school. It is still more undesirable to turn them loose on the community without restraint, because they are potential criminals in a poor environment. It is incumbent on the State, therefore, to care for such children and give them suitable training.

During the course of this survey two marked cases of this type of mentality were found.

State provision for juvenile offenders.—The State of Indiana has established two schools for the correction and reformation of juvenile offenders. That for boys is established on a farm near Plainfield and receives boys committed for crime from 8 to 16 years of age. In the case of incorrigibility, however, the commitment age is from 10 to 17. The term of commitment continues until the boy is 21 years of age. One-half of the cost of caring for each boy is paid by the county from which he is committed.

The daily average attendance is near 600 boys.

The Indiana girls' school is situated on a farm near Clarmont. The age of commitment for girls is from 10 to 18 years of age. The term of commitment is until 21 years of age.

The daily average attendance is a little over 300.

In Indiana the judge of the circuit court is the guardian of all children who need State protection. In addition the State has formed a board of children's guardians, which is composed of six members, three of whom are required to be women. Each member must be a parent.

The practice of committing juvenile offenders without an attempt to determine their mental status is not a good one. The possibility of a miscarriage of justice by this procedure is very great. It is desirable that courts which deal with children should have attached to them a competent psychologist to determine the children's mental status. Furthermore, the combination of these duties with that of the mental inspection of school children would be practicable. A psychologist attached to the courts could bring about the proper segregation of the feeble-minded in places other than the county almshouse, which is so unsuitable for the purpose.

SUMMARY.

In all, 75 school buildings were surveyed in the rural districts of Porter County, 2,488 children were studied physically and 2,185 mentally.

SANITARY SURVEY.

SCHOOL LOCATIONS.

The elevation of school sites was good in 24 instances, fair in 26, and poor in but 9. Walks were observed at 30 schools, 12 being merely entrance walks. Some of the schools were located in more or less close proximity to nuisances.

The average time taken by children in reaching school was 18.8 minutes. Free transportation was practiced in 10 townships, 345 children being transported at an annual cost of $10,729.88.

A sanitary rating of the school privies never reached higher than 50 per cent at any school. The majority of the privies were of the "pit" type. The upkeep and sanitary policing of the greater number of privies were bad.

SCHOOL BUILDINGS.

Of 75 rural schools inspected, 89.3 per cent were one-story structures and 50.7 per cent were frame. Fifty-seven per cent were more than 20 years old. The basements were waterproof in 16 of the 23 schools having basements.

Ten of the schools faced north, 23 east, 25 south, and 17 west. The state of repair of 43 was good, of 24 fair, and of 8 poor. No fire-fighting apparatus was found in any school; 5 were provided with fire escapes. Cloakrooms were provided in only 38 per cent of the schools inspected.

WATER AND LAVATORY FACILITIES.

The water used in 75 per cent of the schools was obtained from shallow driven wells; 3 schools were connected with town water systems and 2 had wells from 125 to 130 feet deep. Protection from surface drainage was not satisfactory. Sanitary drinking fountains of various stationary types were found in 7 schools, but were in use in only 4.

Facilities for washing the hands were limited, common wash basins being provided in 75 per cent of the schools but not being in use in many.

CLASSROOMS.

Adjustable desks were found in 9.15 per cent of the classrooms. Slate was used for blackboard purposes in 85.5 per cent of the schools. Window shades adjustable from top and bottom for the regulation of admission of sunlight were used in 51.5 per cent of the classrooms.

Daylight was admitted from a desirable direction in only 42.2 per cent of the classrooms. The average ratios of window glass area to floor space for all schools was 15.5 per cent, the maximum being 20 per cent and the minimum 8.

Wainscoting was found in 50 classrooms. The walls and ceilings were painted too dark a green from the standpoint of illumination in 46 classrooms and were white in 20, undesirable because of the high reflection coefficient.

HEATING.

Closed stoves were used for heating purposes in 41.1 per cent of the rural schools, jacketed stoves in 34.5 per cent, and hot-air furnaces in 21.1 per cent. Humidification of classroom atmospheres in all schools was inadequate, the relative humidity being under 40 per cent in a majority of cases. Carbon dioxid was present in 7 classrooms to the extent of 8 parts per 10,000 and in 4 classrooms to the extent of 10 parts in 10,000.

VENTILATION.

Ventilation of 27.6 per cent of the classrooms depended entirely upon a natural circulation of air. The Plenum system of ventilation was employed in 20.8 per cent of the classrooms and the gravity system in 51.6 per cent. In most classrooms depending upon the latter the amount of air supply for each pupil per minute was insufficient. An ample provision of air space was found in practically all of the schools.

PHYSICAL STATUS OF CHILDREN.

A total of 2,488 children (1,253 boys and 1,235 girls) were studied, against a daily attendance of 2,512. Practically 8 per cent of the boys and 10 per cent of the girls were 6 years old and under, and less than 10 per cent of either sex were over 15 years of age.

PHYSICAL DATA.

1. A comparison of the mean height and weight of Porter County rural school children with those of children in other localities shows a deficiency in the former during certain age periods. In general the mean height and weight of children of German, Polish, and Scandinavian origin in the county were higher than the corresponding heights and weights for the county as a whole.

2. The rise of lung capacity in boys from 7 to 18 was constant, except for a decided break between the fifteenth and sixteenth years. The vital capacity of girls was similar to that of boys up to the eleventh year, when a decline in the rate of increase commenced, becoming more marked after the fourteenth year.

3. The chest expansion of boys rose from 1 inch at the sixth year to nearly 4 inches at the eighteenth, while that of girls rose from less than 1 inch at the sixth year to 3 inches at the sixteenth, followed by a sharp decline.

4. The strength of the right hand for boys increased from 9.2 to 34 kilos from the seventh to seventeenth years; for girls the increase was from 8 to 22.9 kilos.

5. Of the boys, 35.1 per cent were dolichocephalic, 44 per cent mesaticephalic, and 17.8 per cent brachycephalic. Of the girls, 41.8 per cent were dolichocephalic, 44.7 per cent mesaticephalic, and 10.5 per cent brachycephalic. The highest per cent of dolichocephalic children were Scandinavian, the highest per cent of brachycephalic Polish.

6. The average respiration rate per minute of boys decreased gradually from 21.1 at the fifth year to 16.8 at the sixteenth year, to rise again slightly later on; the pulse rate decreased rather irregularly from 92 per minute to 78. For girls the average respiration rate decreased from 21.3 at the fifth year to 16.3 at the nineteenth year; the pulse rate varied markedly at different age periods, decreasing from 94.2 at the fifth year to 74 at the nineteenth year.

7. Owing to parental objection, only 158 boys were examined for hemoglobin. Of these, 3 had a hemoglobin per cent of 75, 16 of 80, 51 of 85, 77 of 90, and 11 of 95. Of 130 girls, 18 had a hemoglobin per cent of 80, 29 of 85, 70 of 90, and 13 of 95.

8. The breakfast of 40 per cent of the total number reporting on this point was composed chiefly of carbohydrates (that is, bread and cereals), and that of practically 60 per cent was a mixed diet of carbohydrates and proteids. Only 15 per cent used milk, while 57 per cent used coffee.

DEFECTS AND DISEASES.

Defects associated with the organs of hearing in the case of 1,253 boys and 1,236 girls were observed in 31.2 per cent of the boys and 28.2 per cent of the girls. Affections of the respiratory system including the upper air passages were noted in 35.4 per cent of the boys and 32.2 per cent of the girls. Defects of the visual apparatus were noted in 47.2 per cent of the boys and in 45.5 per cent of the girls. A number of these defects were of minor character.

Impaired hearing was observed in 13 per cent of the boys and 11.3 per cent of the girls.

Adenoids were present in 13.2 per cent of the boys and 9.8 per cent of the girls. Various grades of pharyngitis and nasal catarrh were observed in 39 boys and 50 girls, or 3.6 per cent of the total examined. Enlarged or diseased tonsils were observed in 195 boys and 190 girls, or 15.4 per cent of the total examined.

Only 2 cases of tuberculosis were encountered.

Sixty per cent of the boys and 50 per cent of the girls had some degree of dental defectiveness. Of the boys, 54.5 per cent and of the girls 44.2 per cent had two or more defective teeth. The extent to which dental correction had been practiced among children was slight up to the eighth year. The percentage of dental work increases from this year on, but in greater relative proportion among the girls. Eighteen and three-tenths per cent of the boys and 10.5 per cent of the girls never used a toothbrush, 57.8 per cent of the boys and 48.6 per cent of the girls used it occasionally, and its daily use was noted in but 13.9 per cent of the boys and 40.9 per cent of the girls.

Including errors of refraction, 1,335 visual defects were distributed among 1,142 children, or not quite 1.2 defects for each child. The greatest number of these defects were due to errors of refraction; astigmatism was noted in 953 children, 39.4 per cent of the boys and 36.3 per cent of the girls being astigmatic. Seven cases of trachoma were encountered.

Goiter, or simple thyroid enlargement, was noted in 61 per cent of the school children.

MENTAL STATUS.

Children were classified as normal, retarded, and exceptionally retarded, the latter comprising all children with mental deficiency.

The Binet-Simon tests were used in this survey to show the general mental development of the children examined. In the case of the exceptionally retarded children, however, special methods were employed to determine the mental status of each child so recorded.

Of the 1,087 girls and 1,098 boys examined in the rural schools, 93 of the former and 100 of the latter were below the average mentally, or 8.7 per cent of the whole number. The total number needing specialized instruction was 214, or 9.3 per cent.

Seven girls, or 0.6 per cent, were retarded in such degree that their mental development at adult life would not be greater than that of children. Of these, 28 per cent were below the mean physical development for the county.

Of the boys, 1.2 per cent were exceptionally retarded. Of these, 28.5 per cent were below the mean physical development of the county as a whole. Of the total school population, 0.9 per cent were mental defectives. The percentage of exceptionally retarded chil-

dren recorded in the county is considerably less than that found by other observers in other localities.

Of the physical defects associated with retardation, those of the special senses, with the exception of defective hearing, were found in greater proportionate numbers among children who were simply retarded. The exceptionally retarded children were above the average stature of the county in greater proportionate numbers than retarded children.

The undue number of one-room rural schools in the county which were of faulty construction, with poor equipment, and with imperfect teaching facilities were largely responsible for the retardation found in the county.

The average loss of grade by 193 children, as recorded by teachers, was 1.28 years for girls and 1.5 years for boys, a total of 269 school years.

No special classes for the instruction of retarded children were found in any of the rural schools of the county.

In addition to the 214 children who were retarded and exceptionally retarded, 3 epileptics and two constitutionally inferior children were found among the school children of the county.

CONCLUSIONS.

The conclusions based on these surveys are to the following effect:

(1) There is an undue number of one-room rural schools in the county.

(2) An attempt has been made in the construction of the larger consolidated schools of the county to rectify some faults of school construction outlined in this survey.

(3) Of the special causes of unfitness of school buildings for school purposes may be mentioned an undue number of old buildings which have largely passed the limits of usefulness for educational purposes. A number of these schools were situated in undesirable proximity to nuisances; were not provided with sanitary privies; were without a water supply; had faulty illumination of classrooms; were without adequate classroom equipment; were improperly heated and poorly ventilated; were deficient in cloakroom accommodations; and presented evidences of inefficient janitor's service.

(4) The large number of children presenting physical defects of such gravity as to demand specialized medical and surgical attention is an evidence of the need of medical supervision of the school children of the county in the interests of the child's educational advancement and for the protection of the community health.

(5) The undue number of mentally defective and retarded school children revealed by these examinations emphasizes the necessity of the mental classification of the children of the county for the purpose of revealing those who are in need of institutional or individualized treatment.

RECOMMENDATIONS.

The following recommendations are in harmony with the conclusions specified:

(1) Especial effort should be made to consolidate an additional number of the rural schools of the county wherever this may be practicable.

(2) In cases where consolidation can not be accomplished a number of rural schools should be remodeled so as to render them sanitary.

(3) Greater attention should be given to the daylight illumination of a number of classrooms of the county. Windows should be rearranged and the interior decorations selected to meet the requirements of light diffusion most desirable for visual comfort.

(4) All of the schools of the county should be provided with sanitary privies for the protection of the school water supply and as an example in personal and public hygiene.

(5) Each school in the county unconnected with a general water system should be provided with individual sources of water for drinking purposes. These should be properly protected against surface drainage. Furthermore, the practice of obtaining the water for school puposes from neighboring farmhouses should be discontinued.

(6) The heating of classrooms by closed stoves should be prohibited and greater attention given to the upkeep and installation of heating plants.

(7) Ventilation by the routine opening of windows should be a requirement, and the installation of protected openings to the outside air should be provided in all classrooms heated and ventilated by the gravity method.

(8) Better cloakroom accommodations should be provided in all schools and the use of classroom walls and entrance halls for this purpose prohibited.

(9) Greater security against fire in the larger consolidated schools should be obtained through the installation of fire-fighting apparatus, properly arranged fire escapes, and the institution of regular fire drills.

(10) The duties of medical inspector of schools should be combined with those of local health officer.

(11) A full-time officer should be required to be appointed for the discharge of these combined duties, thereby preventing the

spread of disease in the school and improving health conditions in the county.

(12) It would be desirable for the above-mentioned officer to be affiliated also with the juvenile courts or other courts having jurisdiction over juvenile delinquents to make mental examinations of such offenders for the purpose of mental classification in the interest of justice.

(13) Steps should be taken to secure institutional treatment for the mental defectives in the county.

(14) Measures should be taken to secure special classes and individualized instruction for children who are simply retarded and fail to make grade.

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UNITED STATES PUBLIC HEALTH SERVICE

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AUGUST, 1916

INFLUENCE OF OCCUPATION ON HEALTH DURING ADOLESCENCE

REPORT OF A PHYSICAL EXAMINATION OF 679 MALE MINORS UNDER 18 IN THE COTTON INDUSTRIES OF MASSACHUSETTS

By

M. VICTOR SAFFORD
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PREPARED BY DIRECTION OF THE SURGEON GENERAL

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INFLUENCE OF OCCUPATION ON HEALTH DURING ADOLESCENCE.

REPORT OF A PHYSICAL EXAMINATION OF 679 MALE MINORS UNDER 18 IN THE COTTON INDUSTRIES OF MASSACHUSETTS.

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In accordance with requests from the Massachusetts Child Labor Commission and the State Board of Labor and Industries, the United States Public Health Service detailed the writer to cooperate with these agencies in studies of the influence of occupation on persons during the period of adolescence, with a view to standardizing methods of oversight of such persons to protect their health in the industries. As a preliminary step there was needed definite trustworthy information regarding the actual physical condition of minors at work in the various industries of the State. It was therefore decided to try to secure such information by making physical examinations of minors actually at work in the various industries. This was done pursuant to a provision of the Massachusetts statutes (chap. 537, sec. 3, act of 1907) which reads, that an inspector of the State Board of Labor and Industries "shall inform himself concerning the health of all minors employed in all factories within his district, and whenever he may deem it advisable or necessary, he shall call the ill health or physical unfitness of any minor to the attention of his or her parents or employers, and to the State Board of Labor and Industries." The present report gives the results of physical examinations of male minors in the cotton industries of Massachusetts.

The term "minor," so far as industrial employment is concerned, is defined by Massachusetts law as a person under 18 years of age. In Massachusetts the administration of practically all laws relating to the employment of labor, factory inspection, and industrial hygiene, is in the hands of the State Board of Labor and Industries, and the law contemplates the supervision of the medical work by a medical director under the designation of deputy commissioner of labor. This position was vacant until June, 1915, when it was filled by the appointment of Dr. Thomas F. Harrington.

The cotton manufacturing industry of the State was selected as the first field for investigation, both on account of the large proportion of minors which this industry employs and because of the public attention which has been directed to their employment in this industry.

Every cotton manufacturing center of the State has been covered by the field work. Six hundred and seventy-nine boys between the ages of 14 and 18 have been subjected to as careful physical examinations as practicable. In each locality mills have been selected for investigation, so as to secure physical examinations (1) of boys from mills of both old and modern construction, (2) of boys employed in the manufacture of all the different varieties of cotton fabrics represented in the locality, and (3) of a sufficient number of boys of each nationality or race represented among mill employees to justify comparisons. In all mills selected for investigation every male minor employed was examined physically.

In every instance but one it was found possible to provide a room in the office building of the factory for the examinations, and in this one instance rooms in a private house adjacent to the factory were secured. Not only has there been no objection on the part of a mill management to having such rather elaborate examinations conducted on their premises, but when the purposes of the examinations were understood the work of the examiners has invariably been facilitated in every possible way by everyone in authority in the mills.

In conducting the examinations the examination blank given in the appendix was carefully followed, and all apparatus necessary for the purposes indicated therein was brought to the room selected before beginning actual work and installed with a view to such convenience of operation as conditions permitted. In some instances, through the courtesy of the mill management, the examinations were supplemented by further investigations of certain cases at local hospitals.

It is to be noted that there appears on the examination form a considerable number of abnormalities which were assumed to be present if not crossed out during the course of the examination. This scheme was adopted to assure the direction of the attention of the examiners to possible defects which otherwise might be overlooked. The boys were invariably stripped to the waist. Owing to the temperature of the mills, the only other garment usually worn was a thin pair of overalls, and even though this garment was seldom entirely removed, it may be said the physical examinations were usually as complete and satisfactory as though every boy had been actually stripped. Most of the boys were either barefooted or wore "sneakers" or slippers which could readily be kicked off.

In further effort to secure information regarding the possible effects of the occupations on boys employed in the cotton mills,

these physical examinations have been supplemented by a study of the records of the hospitals in Lowell, Lawrence, and Fall River, relative to the causes of admission of cotton-mill operatives, whether as dispensary or hospital patients. Although such hospital records suggest several directions in which study might be directed in an investigation of the effect of millwork upon female operatives, so far as males are concerned the information secured from this source seemed to be almost entirely of negative value.

In considering the tabulation of the diseases and defects disclosed by the physical examinations of the boys,[1] it is to be remembered that this investigation was made in a State which has been a pioneer in matters of industrial legislation. Among the provisions of Massachusetts laws which have a direct bearing on the employment of minors and which, the results of these physical examinations indicate, are being enforced even more effectively than is generally supposed, the following may be cited. No child under 14 years of age is permitted to be employed in any capacity in an industry like a cotton factory. No person under 18 can be employed in a cotton factory without an employment certificate issued by the local school authorities, certifying that the person has complied with certain educational requirements prescribed by law; and if the person be under 16 years of age, he must have in addition a certificate from a physician authorized by the school authorities, declaring the minor to have been physically examined and found physically fit to perform the particular kind of work specified in the certificate. A change in the character of the work calls for a new certificate. In other words, every boy who was physically examined in this investigation, and who started to work before he was 16, had been examined by a physician under the direction of the local school authorities before he was allowed to go to work.

Under Massachusetts laws no minor less than 16 years of age is permitted to work more than 8 hours a day nor more than 48 hours a week, and no boy between 16 and 18 years is permitted to work more than 10 hours a day or 54 hours a week. The Massachusetts statutes also enumerate certain kinds of work in which the employment of minors is prohibited and empower the Board of Labor and Industries to add to the number if it sees fit.

Among the machines which minors under 16 are forbidden to operate or assist in operating the following may be cited as examples: Circular or band saws; wood shapers; jointers or planers; picker machines used in picking wool, cotton, hair, or any other material; leather burnishers; job or cylinder printing presses operated other than by foot power; stamping machines used in metal manufacture; metal or paper cut-

[1] See p. 28.

ting machines; laundering machinery; practically all machinery used in shaping or handling iron plates, in work involving proximity to moving belts or gears, etc. Under 18 they are not permitted to work in or about blast furnaces, oiling or cleaning "hazardous" machinery in motion, at polishing or buffing, switch tending, in the manufacture of explosives, matches, alcoholic liquors, etc.

It is to be remembered that this investigation is made in a State free from hookworm infection, at least so far as the native population is concerned; practically free from malaria, at least so far as cotton manufacturing centers are concerned; a State with a very low typhoid fever morbidity rate, and where the prevention of tuberculosis and protection of public health generally has been given considerable attention. Furthermore, in all the localities covered by this investigation there are well-equipped hospitals, and an effort is made, at least, to comply with a State law requiring a medical supervision of school children.

DESCRIPTION OF THE MANUFACTURE OF COTTON FABRICS.

As shown by Table No. 2 (p. 12), the boys examined were found engaged in the performance of a variety of tasks in the mills, each kind of work being designated by a technical term well understood in the textile industry. The general character of the labor involved in each instance will appear from a brief description of the manufacture of cotton fabrics.

The bales of cotton are opened up in what is ordinarily referred to as the "opening room," which may or may not be entirely shut off from the "picking room," where the cotton undergoes the first stage of its preparation for the manufacture of cloth. As the bales arrive at the mill with all the dirt that has been accumulated on their journey since leaving the cotton gin, their opening is attended with the production of more or less dust, even when "breaking" machines are equipped for removal of dust. No minors were found engaged in this work.

The object of the process to which the cotton is subjected in the "picking room" is further to break up compressed bunches of cotton and remove all dirt, seed husks, moats, fibers, or snarls, leaving nothing but workable cotton at the end. This is accomplished entirely by automatic machinery. The cotton is fed from the bins into hoppers, whence it passes through a succession of revolving rollers and cylinders, which have the effect of repeatedly picking the cotton apart, pressing it, and sifting it. The amount of dust evolved in the picking process depends upon the kind of picking machinery in use.

From the picker the cotton automatically goes through the "carding" process, in which it is compressed into a flat matlike affair or "lap" and passed under revolving toothed cylinders, the effect being to reduce the cotton to a homogeneous consistency and to cause the

fibers to assume a parallel direction. At the end of the carding process the compressed cotton mat or "lap" is split up into thick ribbons or "slivers," which are automatically coiled into portable receptacles provided for the purpose.

In the mills manufacturing coarser fabrics, as these "slivers" come from the carding machines they may be directly subjected to the twisting preliminary to the spinning process. Where the finer goods are manufactured, the cotton must be first "combed."

The object of combing is to remove from the cotton the short fibers. In this process the "slivers" are fed into machines which again press them together in the shape of a fleece or "lap," but a much narrower "lap" than in the carding process. After combing out the short fibers with revolving toothed cylinders, these machines again split the cotton up into "slivers" and coil them into portable receptacles as before. Absorbent cotton is the rejection of combing machines. Whether subjected to "combing" or not, the "slivers," which thus far are held together merely by the result of the compression to which the cotton has been subjected by revolving rollers, are combined ("drawn") and twisted to some extent to give them sufficient tensile strength to stand actual spinning. At the end of this intermediate process the "slivers" or "roves," as they are now commonly referred to, come out wound on bobbins.

The transfer of the full bobbins from the "jacks," as the last machines in this intermediate process are called, to the spindles on the spinning machines is done by human hands. The full bobbins are taken off the jacks, put into basket hampers on castors, which are pushed along by a man or boy as he loads the hamper and thence along the rows of spindles on the spinning machines as he removes empty bobbins from these spindles and replaces them with the full ones from the hamper.

By the spinning process the "roves," as they come from the "jacks," are converted into "yarns." In the spinning process the "roves" are combined, stretched, and twisted, the amount of building up, the rapidity of twisting, and the degree of tension being varied in order to assure the strength, size, and consistency of threads or "yarns," desired for the particular kind of fabric to be manufactured. The character of the yarn is also varied according as it is to form the "warp," or longitudinal threads of the cloth, or the "weft," or "filler," or cross threads of the cloth.

There are two general types of spinning machines in common use, known, respectively, as "mules" and "ring spinners," or "frames." Each type may vary somewhat with different manufactures of textile machinery; but the essential difference between the two types of machines is that the "mule" alternately twists a few feet of the "yarn" and then winds the twisted section on a bobbin, while in

the "frame" machine the twisting and winding proceeds simultaneously. Whichever type of spinning machine may be used, when once the "roves" are arranged to give a "yarn" of a desired strength, size, and consistency, the spinning is supposed to proceed automatically. The mill operative known as a "spinner" to-day is supposed merely to see that the machine is working properly and to join again the ends of yarns which may break in the spinning process. The operative who keeps a "mule" supplied with full bobbins of "roves" in the manner already described is known as a "back boy."

The operatives who replace the full bobbins with empty ones, rolling the hampers along the rows of spindles, throwing in the full bobbins, and taking out empty ones to replace them, are known as "doffers."

After the cotton has been put through the spinning process the "yarns" designed to form the "warp" or longitudinal threads of the cloth receive special treatment in what may be termed the spooling, warping, and slashing department. The "warp yarns" are first wound from the bobbins, as they come from the spinning machines, onto "spools" large enough to take the contents of several bobbins. As the end of the yarn on one bobbin is reached the operator of the machine ties to it the yarn from another bobbin, so that the spool holds a continuous yarn. This tying is now usually done by an automatic tying device held in the operator's hand. From the spool the yarn is wound on a "warper," which puts all the yarns that are going to form the warp of a piece of cloth on a "section beam." This "beam" is a large heavy reel somewhat longer than the width of the cloth to be manufactured. In order to give the warp yarns the firmness and smoothness necessary for weaving they are sized. To do this the yarns are unwound from one beam and wound on another and in the meantime passed through a "slasher" containing a hot solution of starch and other ingredients. Where colored fabrics are woven, or where colored figures are woven into the fabric, the yarns are passed through dye solutions in a somewhat similar manner, although yarns may be dyed in "hanks" and "weft yarns" perhaps on the bobbins.

In the case of prints the colored figures are printed into the cloth by passing it under printing rollers after it has been woven and bleached.

When the warp has been "sized" and wound on the "beam" the end of each individual "yarn" must be threaded through a corresponding pendant loop or eye in an arrangement called a "harness" which holds the warp in place in the loom. This tedious work is now usually accomplished by machines invented for the purpose. Such machines at present, however, are not likely to give perfect results, so that their work must be carefully inspected and probably a greater or less number of yarns threaded through their loops by hand. Those

boys stated (in Table No. 2) to be employed at "drawing in" were engaged in or assisting in this work. The two boys designated in Table No. 2 as "beam changers" were employed in shifting the "warp beams" about the "slasher" or wheeling them to and from the weaving rooms.

The warp as thus prepared is fed to the looms from the "warp beam." The "weft" or "filler" is fed from bobbins just as it came from the spinning machines, except when dyed. The looms, like all other machines in a cotton mill, are intended to work automatically. The weaver, like every other operative in a mill, merely sees that the loom is supplied with material for its work and is working properly and remedies occasional defects of its operation. There is no opportunity for a cotton-mill operative to increase output by speeding up a machine. He can only increase his output by increasing the number of machines he can attend to and produce work of an acceptable quality. While all looms are intended to be automatic, the term "automatic loom" is applied to a newer type of loom lessening the need of attention from a weaver. It is equipped among other things with an electrical device which causes the loom to stop automatically if a warp thread breaks and a "magazine" which feeds bobbins of "weft yarn" automatically to the loom. It is the function of the "battery boy" referred to below to keep these magazines supplied with bobbins of "weft yarn." [1]

One essential to the manufacture of cotton fabrics is a certain degree of relative humidity in the atmosphere. Moisture is necessary to give the cotton fibers the requisite degree of pliability and cohesion, but above all atmospheric moisture is necessary to maintain good electrical conductivity in the air and prevent the accumulation of static electricity in the cotton as it is being worked.

The old way was to admit steam into the room from jets from steam pipes. While this old process was used in parts at least of many if not most Massachusetts mills visited, the so-called humidifiers, of which there are several types, are in common use and are supplanting the old steam-jet system. In principle the humidifier is an apparatus attached to the ceiling of a room, from which water in the form of a fine spray is blown out by compressed air. Humidifiers are generally made to work automatically, starting the spray when the relative humidity falls below a certain percentage and stopping when the humidity of the air is raised sufficiently. They are preferable to the steam jets because they insure a more constant supply of moisture and better distribution. This matter of temperature and humidity of the mills is further considered in another part of the report.

[1] Among the mills investigated was one where hosiery was manufactured. In this the preparation of the cotton was essentially the same as has been described, but the yarns are built up to be bulkier and knitting machines replace looms.

GENERAL RESULTS.

TABLE NO. 1.—*Departments of the mills in which male minors were found employed and the number employed in each.*

Department.	Male minors employed.	Department.	Male minors employed.
Spinning (ring)	259	Hose finish (hosiery mill)	3
Weaving	167	Box (cloth room)	3
Spinning (mule)	125	Button (hosiery mill)	2
Carding	27	Harness (spooling, warping, and slashing departments)	2
Cloth (inspection, baling, and shipping of cloth)	22	Machine (machine shop)	2
Twisting (spinning department)	12	Electrical	2
Knitting (hosiery mill)	12	Picking	1
Drawing-in (helping girls to attach warps to harnesses—spooling, warping, and slashing departments)	9	Dyehouse	1
		Yard	1
Napping (special process for putting soft finish on certain fabrics)	5	Rolling (cloth department)	1
		Press (cloth department)	1
Slashing (giving sizing to warp—spooling, warping, and slashing departments)	4	Carpenter	1
		Cuff (hosiery mill)	1
		Blanket (storeroom)	1
		Office	1
Winding (spooling, warping, and slashing departments)	4	Marking (cloth room)	1
		Designing	1
Combing (carding department)	4	Tin shop	1
Spool (spooling, warping, and slashing departments)	3	Total	679

TABLE NO. 2.—*Special work and ages.*[1]

[The occupations stated in this table are those in which the boys were actually found at work at the time of their examinations.]

Special work.	14 to 15 years.	15 to 16 years.	16 to 17 years.	17 to 18 years.	Total.
Sweeper	42	59	39	14	154
Back boy	25	28	34	18	105
Weaver	12	18	34	36	100
Doffer	1	2	32	45	80
Helper	2	3	12	20	37
Cleaner	2	10	7	5	24
Drop wire boy	6	6	6	5	23
Spinner	1	8	9	4	22
Battery boy	3	4	6	3	16
Spare hand	1	2	6	7	16
Bobbin boy	.....	2	5	3	10
Tuber	5	2	1	.....	8
Oiler	.....	.....	3	4	7
Folder	.....	.....	2	3	5
Clerk	.....	.....	2	3	5
Yarn boy	.....	.....	3	2	5
Stenciller	1	.....	2	1	4
Winder	.....	.....	1	3	4
Twister	.....	.....	2	2	4
Roving boy	.....	.....	2	1	3
Belt boy	.....	.....	2	1	3
Picker	1	.....	1	1	3
Weigher	.....	1	2	.....	3
Cutter	.....	.....	1	2	3
Stitcher	1	.....	2	.....	3
Eyelet machine	.....	.....	2	.....	2
Box boy	1	.....	1	.....	2
Tool boy	1	1	.....	.....	2
Packer	.....	1	.....	1	2
Beam changer	.....	.....	.....	2	2
Carpenter	.....	.....	.....	2	2
Chain pegger	1	.....	1	.....	2
Comber	.....	.....	1	1	2
Sewing machine	1	.....	.....	.....	1
Machinist	.....	.....	.....	1	1
Cloth booker	.....	.....	1	.....	1
Cloth inspector	.....	.....	.....	1	1
Steam tender	.....	.....	.....	1	1
Presser	.....	.....	1	.....	1
Drawing-in boy	.....	.....	.....	1	1
Size maker	.....	.....	.....	1	1
Harness cleaner	.....	.....	1	.....	1
Peg boy	.....	.....	1	.....	1
Planer	.....	.....	1	.....	1

TABLE NO. 2.—*Special work and ages.*—Continued.

Special work.	14 to 15 years.	15 to 16 years.	16 to 17 years.	17 to 18 years.	Total.
Solderer				1	1
Carder			1		1
Grinder				1	1
Sleeve boy				1	1
Cuff boy				1	1
Total	107	147	227	198	679

[1]DEFINITIONS.

Sweeper: Term applied to boys in spinning rooms who keep floor clean with brooms or mechanical sweepers.

Back boy: Shifts roving bobbins on mules, i. e., keeps the type of spinning machine known as a "mule" supplied with full bobbins of the cotton which has been prepared for the spinning process, and removes empty bobbins.

Doffer: Removes filled bobbins from either "mules" or other type of spinning machine known as "frames" and puts in place of the filled bobbin an empty one to receive the product of the machine.

Helper: Usually applied to a boy who helps a mule spinner look after broken yarns.

Cleaner: So far as above list is concerned, the cleaners were employed in keeping the spinning frames from becoming clogged with lint or grease. A few, however, in the same way keep looms clean.

Drop-wire boy: A term applied to a boy who hangs a small piece of metal ("drop wire") over each warp yarn in a certain type of loom so designed that when a warp breaks the "drop wire" drops and makes an electrical connection which stops the loom.

Spinner: Runs spinning machines, either mule or frame.

Battery boy: Keeps the "magazines" on an automatic loom supplied with full bobbins.

Bobbin boy: A boy in either the spinning or weaving room who picks up empty bobbins and returns them to their proper places.

Tuber: Boy who follows a doffer and slips over the steel spindles little paper cylinders or tubes to prevent bobbins from slipping on the steel spindles and to facilitate removal of bobbins.

Spare hand: A helper anywhere or one who "fills in" in the absence of regular operatives.

Folder: Folds cloth when necessary in cloth room.

Yarn boy: Helps in arranging bobbins of warping yarn to be spooled preparatory to winding on the warping beams for sizing. Sizing being the application of the starch mixture to the warp yarns in a "slasher."

Winder, twister: Both attend to bobbins in spooling department.

Roving boy: Boy in the carding or mule spinning room who handles the roving, that is, the coarsely twisted cotton being prepared for the spinning stage.

Belt boy: Boy so designated helped on repairing leather machinery belts.

Picker: Virtually means anyone who works in the picking room.

Cutter, stitcher: Assist in the preparation of cloth for the printing in mills where prints or calico are manufactured

Box boy, packer: Assist in preparing cloth for shipment in cloth room.

Beam changer: Handles or assists in handling the heavy reels or "warp beams" on which the warp yarns are wound for the sizing process and also from which the warp yarns are again unwound to feed the looms. While the beams are rather heavy affairs the need of physical strength in handling them is lessened by mechanical appliances provided for this purpose. Two strong 17-year old boys were found employed as beam changers.

Chain pegger: In connection with the mechanism of a loom designed to weave fancy cloth there is a flattened, chain-like affair bored on one side with holes for small iron pins or "pegs." The location of the pins determines the form of the pattern in the cloth as it is being woven. The chain pegger puts the iron pins or pegs in the holes in the chains as indicated preparatory to starting to weave cloth of a certain pattern or removes the pegs after the cloth has been woven.

Comber: Attends to combing machines in the carding department.

Cloth booker: A cloth-room clerk.

Presser: Attends to a machine in the napping room where the surface of the cloth is scratched up to give it an appearance like Canton flannel.

Drawing-in boy: Assists girls in attaching warp yarns to harnesses, a harness being the device for holding the warp yarns in a loom.

Size mixer: Mixes the starch and other ingredients for the sizing solution.

Harness cleaner: Cleans and repairs the loom harnesses after use.

Peg boy: Same as "chain pegger."

Planer: The boy so designated in the above table apparently ran a planing machine in the department where the packing boxes were made.

Carder, grinder: Operatives in the carding room.

Sleeve boy, cuff boy: Attend to machines in hosiery mills.

OCCUPATIONAL HAZARDS.

As may be inferred from the above description of the wide variety of duties at which these boys were found employed, investigation showed that practically all were engaged in work that required very little actual physical exertion at any time. The most notable exception to this statement was the employment of two strong 17-year-old boys as "beam changers," but even in this instance the amount of muscular exertion called for was not likely to be as great as if the same boys had been employed on a grocery delivery wagon. It is of course true that even the lightest work if sustained for a considerable period may prove decidedly exhausting, particularly if monotonous or involving nervous tension or eye strain. It is conceivable that at times the powers of endurance of some of the boys examined may have been taxed by some work that they had to do. Even in "doffing," which ordinarily could not be considered hard work for a normal 14-year-old boy, the employment of older boys or men is found desirable when large yarns for certain heavy fabrics make the bobbins heavy and clumsy. It is entirely possible also that in some mills boys may be employed at work in which none were found engaged in the mills investigated. Nevertheless what impresses one who watches mill boys at their work is the intermittent character of their duties. An effort to estimate the spare time of the boys examined indicated that ordinarily the duties of sweepers, back boys, doffers, and cleaners, duties which most of the boys under 16 years old are found performing, involve a total of about five hours of actual labor out of the eight they are permitted by law to work. For instance, it was understood that the overseer of each department would send boys for their physical examinations as the work of his department permitted, and on completion of the examinations at each mill pains were taken to learn what inconvenience to the work the examinations involved. While it was evident more or less disturbance to the work must have occurred, it was never necessary, so far as could be learned, actually to stop a single machine by reason of the absence of boys for their physical examinations. Their duties could always be attended to temporarily by those remaining.

When this intermittent character of work, as well as the varied bodily movements involved in the performance of the duties of most of the boys are considered, there remains only a few scattering jobs like "drawing-in," "eyelet machine," etc., tending toward the maintenance of a posture which might have an unfavorable effect upon a boy's physical development. There was, however, a noticeable tendency for the taller boys to be stooped, while the shorter ones were usually straight and well set up. In mills, as outside, everything is arranged with reference to the convenience of those of average

height. None of the boys was found engaged in work or working under conditions involving use of the eyes that could be regarded as harmful to persons of normal eyesight. The hazards to boys with defective vision is considered in another part of this report.[1]

The work at which most of the boys are employed in a cotton factory is monotonous inasmuch as it does not necessarily involve more than a repetition of the same manual acts, but unlike the tasks of an elevator operator or the ordinary operator of some special machine in the average modern manufacturing establishment, a cotton-mill operative has an opportunity, if he have the mentality to grasp it, to study the mechanism of most ingenious machinery and to see the part his own tasks play in the whole highly technical and most interesting process of manufacturing cotton fabrics. Superintendents and overseers are developed from boys who possess such mentality.

The work at which boys are employed would appear to involve but a slight hazard in the way of industrial accidents. The acute injuries revealed by the physical examinations consisted entirely of a few trivial cuts or scratches, and out of the 679 boys not more than two showed permanent results of injuries possibly received in the cotton industry.[2]

CHEMICAL POISONING.

Dangers of chemical poisoning can apparently be excluded so far as any work in which male minors were found employed in the course of this investigation, and, except in a few possible instances, so far as work at which male minors are likely to be found employed in the cotton industry. The fact, however, is not ignored that there are certain processes incident to the manufacture of cotton fabrics which do involve possible hazards of chemical poisoning in connection with which minors may be found employed. In connection with the dyeing processes it would appear that there is likely to be exposure to any poisonous effects which the chemicals used may possess. This seems to be especially true of the method of dyeing "in the hank." A wide variety of analine dyes are used in the cotton mills, and the dyeing preparations are so complicated chemically and so subject to experimentation that it would seem that any known chemical which would not destroy cotton fiber might possibly be found sometimes in a dyeing solution. The possible hazards of this phase of the industry, however, received little attention in this particular investigation, as but one boy was found employed in connection with dyeing processes,

[1] P. 30.

[2] One of these two is a boy who had lost a portion of two fingers and suffered from a minor disability of the hand from getting the hand caught in gears. In this instance, through an oversight, however, the record fails to show if the accident occurred in the mill or in some other previous employment.

and he certainly showed no indications of poisoning or other unfavorable effect of his work.

There may also be some possible dangers of chemical poisoning in connection with several processes made use of in the manufacture of "prints" (including the bleaching of cloth); but as no minors were found employed in these processes their possible hazards are not considered in this report.

There was one process involving the use of chemicals with which a few boys were more or less directly connected, and this was "slashing" or the application of "sizing." "Sizing" or thickening is necessary for all single-twist warp yarns. The primary object of sizing is to increase the strength and smoothness of the thread, so that it will be able to stand the strain and friction of the weaving process. The effect of sizing upon the weight, bulk, appearance, and durability of the cloth also has to be considered. To stick down loose cotton fibers so as to strengthen the yarn and to hold in the yarn other ingredients of the sizing, flour or starches of some sort are used. These may include both dextrine and gums. To render the yarn pliable and smooth, tallow, grease, oils, wax, glycerine, and soap are practically the only substances used. For giving mere weight to the yarns china clay, French chalk, and barytes may be put in the sizing. As deliquescents to enable the cotton to retain moisture, magnesium chloride, generally referred to as "anit" is commonly used, although calcium chloride, glycerine, or common salt may be employed for this purpose. As an antiseptic to prevent mildew or other bacterial growths, which may change the color or affect the durability of the cloth, zinc chloride is practically the only substance ever used. In addition to the above Epsom salts or Glaubers salts may be used for weighting bleached or colored cloth.

From the above it therefore appears that sizing is not likely to contain any chemicals the handling or mixing of which would be expected to offer any health hazards.

In the examination of every boy, however, possible indications of chemical poisoning were kept always in mind. As appears from the examination blank, a "lead line" on the gums was looked for as a routine procedure. In each instance finger nails were carefully inspected for signs of erosion or staining. Hands, arms, and the skin generally were examined with reference to dermatitis or other abnormal condition. A single case of a slight dermatitis of the hands and forearms was found, evidently due to the character of the soap used in washing a tender skin. As appears from the tabulation of defects, acne was not uncommon and a few boils were found; but in no instance was there reason to suspect chemical poisoning as a cause. Nor was there found in any other instance indications to give rise to suspicions of chemical poisoning from any source.

So far, therefore, as physical effects of usual cotton-factory work in the State of Massachusetts on male minor employees are concerned, the hazards of the industry practically are reduced to the possible effects on the minors of the atmospheric conditions of the mills, not merely on the healthy and vigorous but on those who may be in some way or other abnormal.

Then, too, one can not conduct an investigation of this character without thinking of what might be termed the possible "moral hazards" of cotton-factory employment. The boys found performing the ordinary duties of mill boys varied as much in mental capacity and motives for entering this employment as they did in physique. In the mills examined during the summer there were found school boys who had taken this means of earning money for themselves for a portion of their summer vacations. On others fatherless families were depending for support. Some were working to support a father who had himself quit work as soon as he could put enough children at work in the mill to enable him to live without working himself. Many had been taken out of school as soon as the law would allow and made to go to work by parents, themselves mill operatives, who regard children as assets to add to the family income. One instance accidentally came to attention in which a mill was paying to one family of operatives $40 a week, and further inquiry showed that such instances were not unusual. Among the boys could be picked out the type on which the future of the textile industry of the State must depend if it is to survive. With them were boys in whom an education ending in the lowest grades of the public school represented the limit of their mental capacity, the frankly feeble minded, the vicious and depraved, even those with actual criminal records.

The cotton factory does not appeal to the average boy in spite of the fact that the industry offers great remunerative possibilities to a boy of some brains and ambition. Whatever may be the reason which brought the boy to work in the mill, he will be usually found talking of doing something else, of learning a machinist's or plumber's trade, or "joining the Navy." This attitude is favored by the fact that cotton factory work is largely a woman's work, and if a boy has not the capacity to rise above the position of a mere operative he is likely later to find himself at a disadvantage in competition with women. Then, too, in a cotton manufacturing center the mill always has something in the way of employment any one can undertake, the physically weak, the shiftless, the improvident, and those who for one reason or another have failed to succeed in other occupations. The extent to which employment in this industry is a temporary occupation for boys under 18 is well illustrated by the fact that, whereas out of the 679 boys examined 425 were over 16 and 198 over

17 years old, yet only 203 had a total of two years' employment in cotton mills to their credit and but 78 a total of three years. Of the 679 boys the total mill employment of 220 was less than six months. It is also to be noted that the mill employment with which the boys are credited was in many instances not continuous but interrupted by employment at other occupations.

RACE OR NATIONALITY.

A majority of the male minors examined were either born in this country or came here very early in life. In the following table they are classified according to the racial extraction or nationality of their parents.

TABLE NO. 3.—*Nationality or racial extraction.*

	14 years old.	15 years old.	16 years old.	17 years old.	Total.
French Canadian	47	58	103	83	291
Portuguese	11	11	37	33	92
English	18	35	21	22	96
Irish	17	14	28	28	87
Greek			3	7	10
Italian	2	2	2	2	8
Polish	9	16	20	8	53
American		4	4	9	17
Miscellaneous	3	7	9	6	25
Total	107	147	227	198	679

PHYSICAL DEVELOPMENT AND STRENGTH.

The following tables (Nos. 4, 5, 6, and 7), show the average weight, physical proportions, and grip strength, according to their ages, of the male minors examined in the cotton factories. The classification as racial or national extraction appearing in the tables is based on the race or nationality of the parents. The strength of grip test shown in kilograms was as registered by a Collin's dynamometer. The height measurements are without shoes. The boys were not weighed stripped; but they were often clad only in overalls and undershirt, and it is believed that 4 pounds would be a very liberal estimate of the average weight of clothes worn at the time the weight was taken.

PHYSICAL DEVELOPMENT ACCORDING TO RACIAL OR NATIONAL EXTRACTION.

TABLE No. 4.—AGE FROM 14 to 15 YEARS.

Racial or national extraction.	Number examined.	Average height.	Maximum height.	Minimum height.	Average weight.	Maximum weight.	Minimum weight.	Average chest measure.		Maximum chest measure, inflated.	Minimum chest measure, inflated.	Average strength of grip in kilograms.		Maximum strength of grip in kilograms.		Minimum strength of grip in kilograms.	
								Inspiration.	Expiration.			Right hand.	Left hand,	Right hand.	Left hand.	Right hand.	Left hand.
		Inches.	*Inches.*	*Inches.*	*Lbs.*	*Lbs.*	*Lbs.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*						
French Canadian	47	59.60	66.75	53.75	93.80	137.00	70.00	29.60	27.17	34.75	25.50	23.70	22.60	45.00	41.00	15.00	12.00
Portuguese	11	57.70	60.75	53.25	88.60	107.00	72.00	29.45	27.10	31.50	27.00	23.19	22.09	33.00	33.00	9.00	9.00
English	18	59.33	69.50	53.25	93.06	137.50	60.00	29.33	27.35	34.25	24.50	24.55	24.00	35.00	33.00	15.00	13.00
Irish	17	60.40	65.75	56.25	91.61	128.00	76.00	29.45	27.28	33.00	27.00	24.28	23.00	32.00	32.00	18.00	15.00
Greek																	
Italian	2	60.25	62.75	57.75	96.00	116.00	76.00	29.80	28.25	32.00	27.75	28.00	28.00	31.00	32.00	25.00	24.00
Polish	9	58.90	63.25	56.75	89.40	110.00	75.00	29.20	27.10	30.00	25.00	25.63	24.55	38.00	36.00	18.00	14.00
American																	
Miscellaneous	3	62.40	63.25	61.57	101.00	116.00	88.00	30.80	28.20	32.50	29.25	26.00	22.67	33.00	31.00	20.00	13.00
All nationalities	107	59.52	69.50	53.25	92.60	137.50	60.00	29.52	27.25	34.75	24.50	24.38	23.11	45.00	41.00	9.00	9.00

TABLE No. 5.—AGE FROM 15 to 16 YEARS.

		Inches.	*Inches.*	*Inches.*	*Lbs*	*Lbs.*	*Lbs.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*						
French Canadian	58	61.25	66.75	56.25	119.50	162.00	73.00	30.75	27.00	37.50	26.25	27.80	26.80	42.00	43.00	15.00	13.00
Portuguese	11	60.50	65.75	56.75	109.00	129.50	82.50	31.00	29.00	35.50	28.00	27.50	27.00	43.00	37.00	20.00	20.00
English	35	62.60	68.75	55.75	108.00	139.00	80.00	31.25	28.75	36.50	27.00	29.00	28.00	38.00	41.00	19.00	19.00
Irish	14	60.50	67.75	54.50	95.60	135.00	64.00	29.80	27.40	33.50	26.00	26.50	25.50	41.00	34.00	19.00	15.00
Greek																	
Italian	2	64.25	68.25	60.25	117.50	130.00	105.00	31.80	29.20	30.00	28.50	32.50	32.50	38.00	34.00	27.00	31.00
Polish	16	62.10	67.25	57.75	105.50	140.00	79.00	31.25	29.00	35.00	28.50	28.00	27.00	41.00	39.00	22.00	20.00
American	4	62.80	68.25	58.75	129.75	175.00	85.00	34.50	32.75	40.00	29.50	26.25	25.50	33.00	32.00	14.00	12.00
Miscellaneous	7	63.90	68.25	59.25	112.00	136.00	82.00	32.10	29.70	37.00	29.00	31.00	29.00	42.00	40.00	24.00	20.00
All nationalities	147	61.75	68.75	54.50	112.21	175.00	64.00	31.03	27.93	40.00	26.00	28.14	27.15	43.00	43.00	14.00	13.00

PHYSICAL DEVELOPMENT ACCORDING TO RACIAL OR NATIONAL EXTRACTION—continued.

TABLE No. 6.—AGE FROM 16 to 17 YEARS.

Racial or national extraction.	Number examined.	Average height.	Maximum height.	Minimum height.	Average weight.	Maximum weight.	Minimum weight.	Average chest measure.		Maximum chest measure, inflated.	Minimum chest measure, inflated.	Average strength of grip in kilograms.		Maximum strength of grip in kilograms.		Minimum strength of grip in kilograms.	
								Inspiration.	Expiration.			Right hand.	Left hand.	Right hand.	Left hand.	Right hand.	Left hand.
French Canadians	103	62.50	71.75	55.25	110.80	158.00	74.00	32.00	29.50	37.50	26.50	31.10	29.80	43.00	45.00	12.00	12.00
Portuguese	37	60.93	66.75	54.75	105.11	146.00	75.50	31.22	28.86	37.00	27.00	26.35	25.08	37.00	36.00	13.00	13.00
English	21	62.39	66.50	54.25	105.24	125.00	65.00	30.83	28.39	35.80	26.00	27.86	26.95	40.00	34.00	18.00	14.00
Irish	28	63.24	70.75	56.00	111.84	180.00	73.00	31.75	29.45	41.50	27.50	29.40	24.18	48.00	48.00	20.00	15.00
Greek	3	60.75	61.50	59.75	103.66	105.00	102.00	31.83	29.08	33.00	30.50	28.33	29.66	30.00	31.00	26.00	28.00
Italian	2	58.13	61.00	55.25	99.00	106.00	92.00	32.50	30.05	33.00	32.00	27.00	26.50	31.00	34.00	23.00	19.00
Polish	20	63.56	66.50	58.25	113.28	134.00	92.00	32.39	29.85	38.50	29.00	30.40	29.50	45.00	39.00	21.00	22.00
American	4	61.56	64.75	55.50	104.50	125.00	69.00	31.06	29.00	34.00	27.25	28.50	26.50	36.00	32.00	14.00	13.00
Miscellaneous	9	63.75	71.25	57.25	117.44	192.00	81.00	32.44	29.94	41.00	29.00	32.67	31.22	46.00	45.00	23.00	20.00
All nationalities	227	62.39	71.75	54.25	109.66	192.00	65.00	31.77	29.33	41.50	26.00	29.70	26.68	48.00	48.00	12.00	12.00

TABLE No. 7.—AGE FROM 17 to 18 YEARS.

French Candian	83	63.94	70.25	57.25	117.80	162.00	82.00	32.69	30.18	37.00	28.50	33.84	32.17	62.00	50.00	21.00	19.00
Portuguese	33	62.83	67.25	55.50	111.52	144.75	75.00	32.21	29.78	37.50	27.75	31.27	29.76	50.00	46.00	18.00	12.00
English	22	64.85	69.75	57.50	119.36	144.00	95.00	32.80	30.28	35.00	28.00	32.45	31.45	40.00	40.00	24.00	24.00
Irish	28	65.34	71.00	57.75	124.91	151.00	94.00	33.49	30.88	30.00	30.00	34.75	33.54	44.00	44.00	24.00	26.00
Greek	7	62.21	66.75	56.75	113.71	130.00	94.00	32.64	30.57	35.00	30.00	28.14	27.85	38.00	34.00	20.00	20.00
Italian	2	61.75	62.25	61.25	120.50	122.00	119.00	32.75	30.75	33.50	32.00	36.50	35.50	40.00	39.00	33.00	32.00
Polish	8	63.72	67.25	61.00	116.25	137.00	100.00	33.12	30.75	35.50	29.00	34.50	32.50	45.00	43.00	29.00	24.00
American	9	64.83	67.25	60.75	121.44	137.00	106.00	33.09	30.56	34.75	31.50	32.22	31.67	36.00	35.00	29.00	29.00
Miscellaneous	6	66.20	70.25	61.25	122.75	137.50	103.00	32.69	30.00	35.50	30.50	32.17	31.50	36.00	34.00	28.00	28.00
All nationalities	198	64.07	71.00	55.50	118.05	162.00	75.00	32.77	30.28	38.00	27.75	33.01	31.73	62.00	50.00	18.00	12.00

There does not appear to be any statistical data available for the purpose of a direct comparison of the weight and physical proportions of the boys examined with those of the same ages employed in other industries in the State of Massachusetts, but the tables below, Nos. 8, 9, 10, and 11, may be of interest as showing comparisons with other groups of boys for which similar average measurements are available.

On the second line of these tables are shown[1] the average height and weight for the ages stated of 6,232 boy, 14 and 15 years of age, who were examined for employment certificates in the Borough of Manhattan between July 13, 1914, and April 13, 1915. These boys were measured with clothes and shoes on, and allowance should be made for this fact in comparisons with the boys examined in the Massachusetts cotton factories. The Metropolitan Life Insurance Co. estimates that an allowance of from ¾ to 1 inch should be made for shoes and 8 pounds for clothes in the case of boys of the ages stated. Detailed information furnished by the Metropolitan Life Insurance Co. as to the races of the boys measured indicate that they come chiefly from races in which the adults are notably smaller than the adults of the nationalities represented among the Massachusetts cotton-mill boys.

The third line shows the results of measurements made in 1915 by Prof. C. W. Stiles and Dr. George A. Wheeler, of the United States Public Health Service, on about 770 white American school boys in a southern city "situated in the sandy coastal plain." "Heights were taken in stocking feet (without shoes) and weights were taken with clothes, but without coats or shoes."

The fourth line shows the result of measurements made prior to 1887 by Prof. Dudley A. Sargent, of Harvard University, of students in American preparatory schools and colleges. In connection with these figures it is to be borne in mind that the boys measured must have been largely children whose parents were of the well-to-do American professional and business classes, in which the male adults will probably average as large as any class of men in the world. It is understood that these measurements were made without shoes and stripped.

The figures on the fifth line are taken from Robert's Anthropometry, and show the results of measurements of English boys of the English artisan class made prior to 1890. These heights are without shoes and weights without clothes.

The sixth line shows the classical figures of Bowditch, based upon measurements some 30 years ago of over 10,000 Boston school children of the wage-earning or laboring class. At the same time

[1] Obtained through the courtesy of the Metropolitan Life Insurance Co. from data supplied department of health of New York City.

Dr. Bowditch compiled separately similar figures for what he calls children of the nonlaboring class. These figures are about an inch more for height and about 3 pounds more for weight than the figures appearing in the table below.

On the seventh line of the last table are shown the minimum requirements with respect to height and weight for enlistment as apprentice seamen in the United States Navy, 17 years being the minimum age at which boys may enlist.

COMPARATIVE PHYSICAL MEASUREMENTS.

TABLE NO. 8.—AGE 14 TO 15 YEARS.

	Number examined.	Average height.	Maximum height.	Minimum height.	Average weight.	Maximum weight.	Minimum weight.	Inflated chest.		
								Average.	Maximum.	Minimum.
	Ins.	*Ins.*	*Ins.*	*Ins.*	*Lbs.*	*Lbs.*	*Lbs.*	*Ins.*	*Ins.*	*Ins.*
Massachusetts cotton-mill boys	107	59.52	69.50	53.25	92.60	137.50	60.00	29.52	34.75	24.50
Applicants for employment certificates, New York City	3,405	61.60	.....	.....	103.69	.....	.....	.....	.....	.....
C. W. Stiles, southern school children	50	59.81	67.50	53.25	93.54	154.00	67.50	.....	.....	.....
Dr. D. A. Sargent's measurements of students	(?)	61.90	68.40	56.50	99.00	141.10	68.00	31.50	36.20	28.30
Robert's English school boys	(?)	58.55	.....	.....	79.57	.....	.....	.....	.....	.....
Bowditch's tables	582	59.31	.....	.....	93.67	.....	.....	.....	.....	.....

TABLE NO. 9.—AGE 15 TO 16 YEARS.

Massachusetts cotton-mill boys	147	61.75	68.75	54.50	112.21	175.00	64.00	31.03	40.00	26.00
Applicants for employment certificates, New York City	2,827	62.80	.....	.....	107.10	.....	.....	.....	.....	.....
C. W. Stiles, southern school children	55	62.23	70.25	54.00	109.06	166.75	78.50	33.60	37.60	29.60
Dr. D. A. Sargent's measurements of students	(?)	64.60	70.40	57.00	112.00	154.30	79.40	.....	.....	.....
Robert's English school boys	(?)	60.77	.....	.....	91.43	.....	.....	.....	.....	.....
Bowditch's tables	365	61.90	.....	.....	104.88	.....	.....	.....	.....	.....

TABLE NO. 10.—AGE 16 TO 17 YEARS.

Massachusetts cotton-mill boys	227	62.39	71.57	54.25	109.66	192.00	65.00	31.77	41.50	26.00
C. W. Stiles, measurements southern school children	36	64.48	69.50	57.00	109.25	142.75	77.50	.....	.....	.....
Dr. D. A. Sargent's measurements of students	(?)	67.50	71.20	63.30	132.00	152.10	108.50	35.20	37.90	31.20
Robert's measurements of English school boys	(?)	63.42	.....	.....	107.86	.....	.....	.....	.....	.....
Bowditch's tables	162	64.65	.....	.....	119.03	.....	.....	.....	.....	.....

TABLE NO. 11.—AGE 17 TO 18 YEARS.

Massachusetts cotton-mill boys	198	64.07	71.00	55.50	118.05	162.00	75.00	32.77	38.00	27.75
C. W. Stiles, measurements southern school children	17	66.44	70.00	62.75	126.51	166.00	92.50	.....	.....	.....
Dr. D. A. Sargent's measurements of students	(?)	67.60	71.40	64.20	133.50	154.30	110.00	35.40	38.90	32.30
Robert's measurements of English school boys	(?)	64.95	.....	.....	118.00	.....	.....	.....	.....	.....
Bowditch's tables	77	65.75	.....	.....	125.28	.....	.....	.....	.....	.....
Minimum requirements for enlistment in United States Navy	.....	.....	.....	62.00	.....	.....	110.00	.....	.....	.....

The examiners believe that some of the boys examined in the Massachusetts mills were not so old as the ages which they succeeded in getting themselves entered. They believe that there was evidence of successful evasions of the law to enable the boys to go to work before 14 years of age and also to work "full time" before reaching 16. But it is not believed that such evasions of the law were sufficiently numerous as to affect materially the averages shown in the tables.

While caution is necessary in drawing deductions from measurements of individuals no greater in numbers than were included in this investigation, these tables appear to confirm conclusions reached in this investigation in other ways. In comparison with the measurements of other investigations of other classes of boys the average of the 14-year-old Massachusetts cotton-mill boy, with respect to height and weight, appears to be decidedly low. Even making allowance for shoes and clothes the cotton-mill boys of this age do not compare favorably with the 14-year-old New York City applicants for working certificates, in spite of the fact that other data furnished with respect to the New York boys showed that they were chiefly recruited from races physically much smaller than those to which the Massachusetts boys belonged. The recorded impressions of the examiners at the time of the examination as to the development of individuals indicate that about one-third of the 14-year-old mill boys were physically undeveloped for the age claimed. To some extent this showing may be due to successful falsification of age; it can not, of course, be attributed to an occupation which the boy was just entering.

Between 15 and 16 years of age, on the other hand, the mill boys compare favorably with the New York boys in height, exceed them in weight, allowing for the shoes and clothing of the latter, and in average weight even exceed Dr. Sargent's select class. From 16 years on, however, the average of the mill boys is increasingly unfavorable in comparison with the other classes for whom measurements are available. Even taking the figures for the cotton-mill boys themselves, the 16-year-old boys show a gain of only 0.64 of an inch in average height over the 15-year-old boys and an actual decrease of 2½ pounds in average weight.

In connection with the table of physical defects shown farther on in this report,[1] it appears that at the time of their examinations 193 of the 679 boys impressed the examiners as being conspicuously undersized. It is also to be noted from this table that the proportion of undersized boys decreases as length of employment in cotton mills increases. Among the undersized boys two types were in

[1] P. 28.

evidence. One type well formed physically but developing more slowly perhaps than does the average boy at the ages of the boys included in this investigation. This type of boy, undersized at 14, may at 21 be physically superior to the one whose growth at about 14 was the more rapid. The other type of undersized was a physical type in which normal physical development could never be hoped for.

There are few opportunities for employment open to an undersized boy of 14. The cotton mill, however, may offer such an opportunity, and perhaps the only one in a cotton manufacturing center. Undersized boys at 14 who go to work at that age therefore naturally tend to gravitate to the mills. Under the laws of the State, boys, no matter how robust, until they are 16, are shut out from all "full time" occupations, including the more attractive trades. The cotton mills, however, offer employment to boys who for one reason or another may leave school before they are 16. As a result there is an accumulation in the cotton mills of strong husky boys just under 16. This fact is reflected in the tables by the high average height and weight of the boys between 15 and 16 years old examined. After reaching 16 this type tends to disappear from the industry, leaving a preponderance of those whose occupational possibilities are limited by their lack of physical strength.

In this investigation no attempt was made to consider the female minor in the cotton manufacturing industry, but it seems fair to assume that with them the cotton mill is likely to represent a more continuous vocation.

In the matter of chest measure, the only figures available in the tables for comparison with the cotton-mill boys are those of Dr. Sargent's students. It is to be noted that the cotton-mill boys show much wider variations in this respect than the students and that for all ages the average chest measures of the cotton-mill boys are below those of the students. This difference, it is believed, is to be adequately accounted for by the class of the population from which the majority of the boys in each instance may be expected to be drawn. Even in the physical examinations which officers of the Public Health Service at Boston are making of applicants for appointment in the United States Civil Service, candidates for appointment to professional positions are markedly taller, heavier, larger in chest measure, and bigger in muscular development than candidates for positions as mechanics, laborers, or clerks.

In the matter of grip test as indicated by the Collin's dynamometer, no figures could be found for purposes of comparison. This instrument is really designed for the detection of pathological conditions rather than for comparative strength tests, and, moreover, for the mere purpose of testing the strength of grip, the type of dynamometer

used is not entirely fair, as the amount it can be made to register will depend more or less on the size, shape, and toughness of the skin of the hand. It is believed, however, that such dynamometer tests in an investigation of this character may be made to serve a useful purpose, particularly if individual instances of marked deviations from the average be studied. In connection with the dynamometer tests in this investigation some features of possible interest were brought out which it is difficult to show by tables. For instance, before many physical examinations had been made the examiners came to expect a 14-year-old boy, regardless of size, to register 23 kilos on the dynamometer. The final tabulation shows this to be very close to the average for this age. A small, well set-up boy, even though he might be characterized as undersized, the examiners came to expect to make as good a showing with the dynamometer as a bigger boy of the same age who gave indications of growing more rapidly. The high records on the dynamometer, the maxima recorded in the tables, are due to a few boys of extraordinary development and strength for their ages. Partly as the result of the dynamometer test the examiners were often led to regard the physical welfare of big, soft, rapidly growing boys as deserving of even more careful attention than others who might justifiably be called undersized.

EDUCATION.

The education that the boys of the different ages and racial or national extractions had received is shown in the following tables (Nos. 12, 13, 14, and 15). Each boy's ability to read or tell letters was brought out in the course of the eyesight examination. This examination included tests for distance with large letters and reading fine print in English or other languages. Foreign boys were tested in their own languages as well as in English, and the boys stated to be illiterate could neither read nor name letters in English nor in any foreign language. Most, if not all, illiterates claimed that they were attending evening schools.

In these tables the education of the boys is shown with reference to the grading of Massachusetts schools, which nearly all the boys had attended. In the few cases in which education had been completed elsewhere in this country, or in a foreign country, the boy is credited with the Massachusetts equivalent as nearly as it could be determined.

YEARS SPENT IN SCHOOL BY BOYS OF DIFFERENT EXTRACTION.

TABLE No. 12.—AGE 14 TO 15 YEARS.

Racial or national extraction.	Number examined.	Last school grade attended.												
		First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	High school.	Graded high.	Night school.	Commercial school.	Illiterate.
French Canadian	47	....	....	....	6	14	13	10	3	1	....	....	....	....
Portuguese	11	....	....	1	2	1	3	3	1	....	....	....	....	....
English	18	....	....	....	....	2	6	3	7	....	....	....	....	....
Irish	17	....	....	....	1	2	4	3	4	2	....	1	....	....
Greek	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Italian	2	....	....	1	....	....	....	....	....	....	....	....	....	1
Polish	9	....	....	....	1	3	2	....	2	1	....	....	....	....
American	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Miscellaneous	3	....	....	....	....	1	....	2	....	....	....	....	....	....
Total	107	....	....	2	10	23	28	21	17	4	....	1	....	1

TABLE No. 13.—AGE 15 TO 16 YEARS.

French Canadian	58	1	1	4	6	10	11	11	12	2	....	....	....	....
Portuguese	11	1	....	....	4	4	1	....	....	....	....	1	....	....
English	35	....	....	....	....	6	9	9	8	3	....	....	....	....
Irish	14	....	....	....	1	....	4	1	5	3	....	....	....	....
Greek	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Italian	2	....	....	....	1	....	1	....	....	....	....	....	....	....
Polish	16	....	....	....	1	2	3	6	3	1	....	....	....	....
American	4	....	....	....	....	1	....	2	1	....	....	....	....	....
Miscellaneous	7	....	....	....	....	1	1	4	1	....	....	....	....	....
Total	147	2	1	4	13	24	30	33	30	9	....	1	....	....

TABLE No. 14.—AGE 16 TO 17 YEARS.

French Canadian	103	....	4	5	18	24	21	14	11	5	....	....	....	1
Portuguese	37	1	....	3	6	8	3	2	2	....	....	4	....	8
English	21	....	....	....	1	2	6	8	2	2	....	....	....	....
Irish	28	....	....	....	3	3	4	6	6	6	....	....	....	....
Greek	3	....	....	....	....	1	....	....	....	....	....	2	....	....
Italian	2	....	....	....	....	1	1	....	....	....	....	....	....	....
Polish	20	....	....	....	2	1	2	3	9	3	....	....	....	....
American	4	....	....	....	....	....	4	....	....	....	....	....	....	....
Miscellaneous	9	....	....	....	....	2	1	2	2	2	....	....	....	....
Total	227	1	4	8	30	42	42	35	32	18	....	6	....	9

TABLE No. 15.—AGE 17 TO 18 YEARS.

French Canadian	83	1	2	8	11	19	13	13	6	8	....	....	1	1
Portuguese	33	....	....	3	4	5	3	....	1	1	....	9	....	7
English	22	....	....	....	1	2	2	5	7	5	....	....	....	....
Irish	28	....	....	....	....	2	5	7	4	9	....	....	1	....
Greek	7	....	2	....	....	....	....	....	....	....	....	3	....	2
Italian	2	....	....	....	....	....	....	....	....	....	....	2	....	....
Polish	8	....	....	....	....	....	3	....	2	1	....	2	....	....
American	9	....	....	....	....	2	2	2	2	1	....	....	....	....
Miscellaneous	6	....	....	....	....	....	....	1	2	3	....	....	....	....
Total	198	1	4	11	16	30	28	28	24	28	....	16	2	10

In Massachusetts the average scholarship has reached the eighth grade of school by the time he is 14, the age at which he is first permitted to do any work which may conflict with school attendance. Among the 679 boys included in this investigation there were 34 who had attended high school and 2 who had attended commercial schools. As has already been mentioned, a considerable number of the boys examined during the summer months had not completed their education but were merely working during their vacation with the intention of returning to school in the autumn. Yet the tables show that of the boys examined, practically all of whom must have passed 14 years of age before going to work, 237 had not even succeeded in reaching the sixth grade of a Massachusetts grammar school or its equivalent, and that 11 were illiterate, being unable to read a word or name a letter in English or any other language.

There are undoubtedly many good reasons why the education of these 237 boys ended where it did. From the tabulation of diseases and defects shown in another part of this report[1] it will appear that some had serious unrecognized defects of eyesight incompatible with progress in school. Some were deaf. Some evidently had during their school days diseased conditions of the nose, throat, and mouth, or other neglected physical defects which must have made school life a torture. Others (just how many can not be stated from this investigation, but the number was by no means small) simply lacked the mental capacity to go any further in school than they did. In some instances it was brought out in the investigation that the mental defectiveness had already been recognized and the boys had been put in special classes for defectives. Most of the illiterates, both foreign and native, were abnormal, and their illiteracy was due to incapacity to learn to read under ordinary methods of instruction. None of the illiterates showed physical defects sufficient to explain their illiteracy.

PHYSICAL DEFECTS AND DISEASES.

While there appears to be no data available for the purpose of a direct comparison of the relative frequency of the diseases and defects found in this investigation and the same diseases and defects in other occupations, or among boys of the same ages in the general population in Massachusetts, it would seem perfectly fair in this connection to consider the following list of the diseases and defects disclosed by the examination of 30,244 children 14 and 15 years of age who applied for employment certificates in New York City between January 1 and September 30, 1915. These figures have been made available through the courtesy of the director of the bureau of child hygiene of the department of health of New York City.

[1] P. 28.

TABLE No. 16.—*Physical defects and diseases.*

	Children examined.	Per cent.		Children examined.	Per cent.
Total	30,244	100	Defective teeth	9,955	32.85
			Pulmonary disease	52	.17
Defective nutrition	717	2.37	Cardiac disease	351	1.16
Defective vision	4,574	15.10	Diseased glands	5,463	18.06
Acute eye diseases	513	1.30	Goitre	198	.65
Defective hearing	290	.95	Skin diseases	56	.18
Defective nasal breathing	880	2.90	Pediculosis	88	.29
Deformed palate	206	.68	Orthopedic defects	165	.54
Defective speech	11	.03	Hernia	34	.11
Hypertrophied tonsils	2,549	8.62	Nervous diseases	85	.28

TABLE No. 17.—*Diseases and defects found among male cotton factory employees between 14 and 18 years of age, with aggregate length of employment in the cotton manufacturing industry.*

Defects.	Total duration of employment in cotton mills.						
	Less than 1 month.	More than 1, less than 6 months.	More than 6 months, less than 1 year.	More than 1 year, less than 2.	More than 2 years, less than 3.	Three years or more.	Total.
Total examined	18	202	77	179	125	78	679
Physically undeveloped (undersized)	7	73	27	58	18	10	193
Defective vision one eye, other eye normal		12	4	18	5	10	49
Blind one eye, other eye normal			2	2	2	1	7
Vision less than 10/20 both eyes	1	17	3	7	9	7	44
Vision less than 10/20 one eye, less than 20/20 in the other	1	2	2	1		2	8
Vision more than 10/20, less than 20/20 both eyes	3	11	6	20	16	11	67
Refractive errors corrected by glasses		1	2		1	1	5
Congestion of conjunctiva		5	3	4	5	1	18
Follicular conjunctivitis				2			2
Blepharitis				2	1		3
Ptosis				1			1
Strabismus	1	1	2	1		1	6
Corneal opacity				2		1	3
Trachoma							0
Color blindness		1				1	2
Deaf one ear, other normal	1	6	1	8	8	1	25
Deaf both ears, cause not apparent	1	11	3	10	4	6	35
Dullness hearing one or both ears, apparently due to cerumen plug	1	21	14	23	12	8	79
Otorrhœa, chronic				3	1	4	8
Acute abscess middle ear—otorrhœa, acute				1	1		2
Deafness and polypi ears			1	1			2
Nasal congestion	3	19	9	12	9	2	54
Chronic nasal catarrh		3	1	2	4	2	12
Spurs	1	14	6	5	8	4	38
Deflected septum	1	6	5	13	7	3	35
Acute inflammation nose and throat	3	36	13	32	26	9	119
Coryza		7	1	5	8	1	22
Pharyngitis	1	25	7	20	18	7	78
Laryngitis					1	1	2
Adenoids		11	1	4	2	3	21
Nasal polypi		1			1		2
Deformed palate		1		6		5	12
Tonsils slightly enlarged	3	48	20	42	28	15	156
Tonsils moderately enlarged	5	23	10	21	16	8	83
Tonsils greatly enlarged		6	1	10	3		20
Acute tonsillitis		1					1
Tongue badly coated			1		1		2
Tongue slightly coated	2	37	12	31	20	17	119
Decaying teeth	8	131	41	102	69	37	388

TABLE NO. 17.—*Diseases and defects found among male cotton factory employees between 14 and 18 years of age, with aggregate length of employment in the cotton manufacturing industry*—Continued.

Defects.	Total duration of employment in cotton mills.						
	Less than 1 month.	More than 1, less than 6 months.	More than 6 months, less than 1 year.	More than 1 year, less than 2.	More than 2 years, less than 3.	Three years or more.	Total.
Unclean teeth	10	111	46	119	61	35	382
Filled teeth	1	19	8	10	16	10	64
Missing teeth	9	97	33	82	51	45	317
Alveolar abscess				1		1	2
Deformity of chest	1	3	5	4	4	4	21
Acute bronchitis		4		3	3	1	11
Thickened pleura				1			1
Pleurisy with effusion		1					1
Pulmonary tuberculosis							10
Organic disease of heart				1	1	1	3
Functional disorder of heart		2	1	6	5	4	18
Pericarditis			1				1
Anemia (?)	3	7	4	8	6	6	34
Enlarged occipital glands	2	4	5	3	2	1	17
Enlarged cervical glands	4	58	19	53	40	14	188
Enlarged axillary glands	7	53	27	50	44	15	196
Enlarged submaxillary glands		1				1	2
Enlarged epitrochlear glands				1		1	2
Inflamed or suppurating lymph glands							0
Scars from former disease lymph glands		4		1		1	6
Goiter, simple			1	1			2
Pediculosis scalp					1		1
Ringworm of scalp (Tinea tonsurans)			1				1
Seborrhea							0
Eczema							0
Pediculosis, body							0
Ringworm of face (Tinea circinata)		1					1
Furuncles (boils)		1		1	2		4
Acne	1	14	5	19	9	11	59
Psoriasis							0
Dermatitis hands or body, dermatitis forearms, from soap			1				1
Scoliosis				1			1
Active tuberculosis of bones or joints							0
Results of former tuberculosis of vertebræ (Pott's disease)					2		2
Results of former tuberculosis of other bones or joints							0
Deformities resulting from rickets			1				1
Round shoulders	2	3	5	11	7	4	32
Mutilations or deformities resulting from occupational accidents				2			2
Bursitis				1		1	2
Knock-knees		1					1
Bow legs							0
Poor arches of feet		6	2	6	7	1	2
Flat feet		1					1
Hernia		1		2			3
Varicose veins							0
Chronic disease of alimentary tract suspected							0
Chronic appendicitis suspected			1				1
Intestinal parasites suspected		1	2	3	1		7
Deformity or partial anchylosis resulting from former injuries bones or joints		1	2	3	3		9
Nephritis				1	1	1	3
Temperature above normal		6	1	3		1	11
Lead or chemical poisoning suspected							0
Slight facial paralysis				1			1
Mental defectiveness suspected	1	7	4	11	9	1	33
Total defects	84	937	373	878	579	339	3,190
Mucous membrane, nose, and throat normal	14	142	56	136	88	83	499

Physically undeveloped.—The figures given in the table in connection with this term represent the personal impressions of the examiners from the appearance of the individual boys after considering the alleged age and average development of other boys of the same age. This matter has already been discussed in connection with the physical measurements of the boys.[1]

Eyesight.—In the actual examination an effort was made in each case of defective vision to determine the extent and character of the defect as approximately as could be done without the use of a mydriatic; but, as in other instances in which it was attempted to rely on the testimony of the boys as to subjective phenomena, conclusions were so often open to question that in the table there is only shown the defectiveness of vision for distance as indicated by the Snellen type tests. It may be stated, however, that in a number of instances there was an evident hypermetropia when the letters on the test card could be read at the distance for normal. It is also to be stated that among the 44 reported in the table to have vision for distance less than 10/20 in both eyes, are a number who showed evidence of most serious abnormalities of the retina and choroid, that is of the light perceiving structures of the eye and in whom the preservation of even their present degree of vision presents a difficult problem. As it happened, no boy with abnormal eyes was found doing work which seemed likely to subject his eyes to any more injurious strain than that to which they would be subjected if he were to be thrown out of work and left to his own devices. Except in a comparatively few special tasks the chances for eye strain were incomparably less than studying in school would involve and the boys engaged in these special tasks were found either to have normal eyesight or to be properly fitted with glasses. This fact, however, does not lessen the importance industrially and otherwise to many of the boys' future of the defects of vision found. Persons with the high degree of nearsightedness which some of these boys showed find that while bothered in seeing at any distance without glasses, they possess without glasses microscopic powers of eyesight for close work and tend to neglect glasses and drift into occupations requiring close, constant application of the eyes; yet such use of their eyes without glasses involves a strain and congestion of their abnormal eye tissues productive of degenerative changes and blindness. The dangers just described do not necessarily apply to all of the 44 whose vision in both eyes is shown in the table as less than 10/20, but all of these as well as many of the rest of the 175 whose eyesight was found to be abnormal should be wearing carefully-fitted glasses if they are to make the most of their possibilities as wage earners or otherwise. Of all found with

[1] See p. 18.

defective eyesight, only five were found to be provided with suitable glasses. Some wore glasses which did them little or no good, but most of them either never had worn glasses or had abandoned their use.

The examiners endeavored to impress upon a boy the necessity of wearing glasses whenever it seemed advisable that he should wear them, but it soon became evident that there are practical difficulties in the way of securing the results to be desired. To families to which many of the boys belonged, the cost of suitable glasses for children with the refractive errors found is in itself prohibitive. Then, too, in some instances the boys frankly said that they would not wear glasses both because they were a nuisance and because other boys would laugh at them. The agent of one mill met the situation for the time being by having fitted and provided with suitable glasses at his own expense all boys in his employ whom the examiners recommended should wear glasses, but in the natural course of events most of these boys will have gone in some other occupation within a year and their places will be taken by others, with similar needs. It is perhaps of interest to note that cases of defective vision were much more common among the French Canadians than the other nationalities examined.

In the foregoing, defects of eyesight due to congenital abnormalities of the eyes are alone considered. A few of the cases of "defective vision in one eye" reported in the table, and a few of those "blind one eye" were due to injuries. None of such injuries had, however, been received during employment in cotton mills. One case of blindness in one eye was due to an albuminuric retinitis associated with chronic nephritis (Bright's disease). In three instances defective vision was associated with corneal opacities from former corneal ulcers of unknown cause. Not a single case of trachoma or other contagious eye affection was found. Only two cases of color blindness were found, although defects in color perception were looked for with special care, particularly after it was seen that the examination was revealing no more cases.

Hearing.—The only feature of their work which any of the boys complained of was the noise of the mill. This is incessant, and particularly in the weaving rooms it is such as to make an attempt at conversation on the part of a visitor exceedingly difficult. Complaints, however, came only from those who had been employed but a comparatively short time. Those employed longer said they "got used to the noise." It was found impracticable to undertake any careful investigation into the character and extent of any possible occupational deafness arising from this cause. In the buildings where examinations were made it was usually not quiet enough for careful auditory tests. Then, too, in conducting these physical

examinations it soon became apparent that partly from lack of intelligence and partly from apprehension regarding possible motives for the examinations it was unsafe to rely on the testimony of the boys as to subjective phenomena or symptoms for any purpose whatever.

In the hearing tests the ticking of watches was relied upon. Two watches were used. Both were standardized, one by several thousand previous physical examinations. The examiner's own hearing had been also found to be normal. In testing the hearing of a boy the examiner stood directly behind the boy, the examiner placing his own ear as near the boy's as possible and listening to the ticking of the watch also. Apparent dullness of hearing to the ticking of a watch was quite common. It soon became evident that to some extent this dullness was only apparent and was due to lack of the mental concentration required to listen to faint sounds. After a little encouragement and experimentation it was found that many of these boys with apparent dullness of hearing could actually hear the watch as far away from the ear as the examiner. Often boys whose hearing for the watch was dull claimed that they were conscious of being "deaf," as they put it, when they first came out of the mill, but that they could "hear as well as ever in an hour or so." On the other hand, boys employed as weavers who had worked in the mill for three years and who came directly from the weaving room to their examinations were found to have an acuteness of hearing for the ticking of a watch equal to that of the examiners. The external auditory canal of every boy was examined, a De Zeng otoscope being used for this purpose, and unless a view was obstructed by cerumen or abnormal growths the ear drum itself was inspected. As might be inferred from the number of cases of an abnormal condition of the upper respiratory passages this inspection of the auditory canal often showed at once sufficient evidence of old middle ear disease to account for the degree of deafness observed. As appears from Table No. 17, there were found at the time of the examination, complicating abnormal throat and nose conditions, two cases of acute middle ear abscesses and eight cases of chronic otorrhoea. As indicated by the table, in 79 instances a dullness of hearing seemed adequately explained by the accumulation of a plug of cerumen or "wax" in the auditory canal. No statistics are available as to the prevalence of this condition in the general population for purposes of comparison, but the frequency with which cerumen accumulations to an extent unquestionably involving interference with hearing were found among the boys arouses a suspicion that there may be an explanation in the occupation or in some habit or practice among mill employees favoring the accumulation of cotton "fly" in the ears and promoting the formation of "wax plugs."

While many cases of impaired hearing were clearly due to the causes above described, and while failure of the examination to reveal the results of some former inflammatory trouble unrelated to the occupation does not mean that some such condition may not have been the cause of impaired hearing, there still remain enough of these unexplained cases of dullness of hearing to indicate that the noise of the cotton mill may so affect the inner ear as to cause a so-called "occupational deafness." This is really no more than might be expected. That such an effect, however, does not inevitably follow was shown by the fact that persons who had been employed longer under the same conditions, some of them players of musical instruments, showed no discoverable impairment of hearing whatever. As to the danger of jumping at conclusions in individual cases, the following may be cited. In one mill six weavers, the first weavers in that mill to be examined, were sent into the examination room together. Four of these were found to be markedly deaf and the acuteness of hearing of the other two to the ticking of a watch was at least as good as that of the examiners. Of the four all were found on examination, confirmed by history, to be deaf from serious middle ear trouble antedating their employment in any occupation.

Nose, mouth, etc.—In making the physical examinations of the boys the mucous membrane of the upper air passages and throat was carefully inspected with special reference to securing and tabulating data which might tend to indicate any irritant effects of the atmosphere of the mills or of gases or chemical vapors, upon the respiratory tract. Anything in the way of an abnormal appearance was noted. Yet in spite of the fact that in three mills, including the largest investigated, there were encountered epidemics of acute colds prevalent at the same time in the general population, there still remain out of the 679 boys, 499 whose respiratory mucous membrane was free from discoverable abnormality. In a great many instances a congestion or inflammatory condition was obviously due to an acute infective process, but in such cases as well as when the cause of congestion might be open to question an effort was made to see if a possible relation could be traced between the department of the mill or the boy's special occupation and an abnormal appearance of the mucous membrane of the nose or pharynx. The result was in all instances absolutely negative. Even in the case of boys from the carding rooms, where the air often appeared dusty from floating lint or "fly," signs of irritation or congestion of the nose were more often absent than present. As indicated by the table, however, this examination did reveal a number of more or less serious conditions of the upper air passages.

Many of the boys had at some time previously been operated on for hypertrophied tonsils and excessive adenoid growths. In many, if not most of the cases noted as having "slightly enlarged tonsils," the hypertrophy was probably of no serious practical importance. In some of these cases an acute cold was also present. But even in these cases of slight tonsillar hypertrophy there was often an association with decaying teeth, suggesting that tonsils were being overworked to take care of the products of bacterial growths in the mouth. Practically all of the 103 cases noted as having "moderately" or "greatly enlarged tonsils," are, however, to be regarded as worthy of serious consideration. In some instances they were associated with other throat or nose conditions likewise calling for attention. They were almost invariably associated with decaying teeth. They were associated with the three cases of organic heart disease found, and in two of the cases there was a history indicating an endocarditis following recurrent attacks of tonsillitis. In many instances these enlarged tonsils were associated with a general physical appearance indicative of systemic poisoning.

Teeth and tongue.—It is worthy of note that but two instances of "badly coated tongue" were found, both apparently due to some acute disorder of the digestive system. The cases of "slightly coated tongue" were almost invariably associated with bad teeth, and probably in most instances representated a permanent condition.

The prevalence of dirty, decaying, and otherwise neglected teeth was the most striking feature of the whole investigation. Inquiry showed that the habitual use of a toothbrush was limited to a comparatively few boys and that even an occasional use of a toothbrush was comparatively uncommon. Of the 679 boys, 388 had decaying teeth demanding the immediate attention of a dentist. In a still greater number of boys a more careful examination of the teeth than was attempted would undoubtedly have revealed beginning decay. Boys who had not reached 17 years of age were found practically without a sound tooth in their mouths. The importance of diseased and inefficient teeth and of the absorption of the toxic products of bacterial growths in these foul mouths as factors in the production of such evidence of malnutrition and anemia as was found can not be overestimated. In every instance when a boy was found to have decaying or neglected teeth he was given a lecture on the importance of attention to his teeth. When a boy's teeth were found clean or with cavities filled, the fact was commented on for the benefit of other boys present. In such a case the boy was usually asked who made him take care of his teeth. The invariable response was his mother. Efforts of the examiners to arouse the boys' interest in the care of their teeth brought out the following information regarding the character of the problem of bringing about better mouth conditions

among boys of the type represented. In many instances there was disclosed such an indifference on the part of the boys and their parents to the preservation of teeth that probably nothing short of some form of compulsion would bring about any effort to improve conditions. When a tooth became too painful to be endured it would be extracted. Three hundred and seventeen boys had had teeth extracted. Only 64 had had teeth filled. There is, however, another important phase of this problem, suggested by the remarks of a boy whose attention was called to the fact that while some of his teeth were properly filled there were others still needing attention. He said: "There are four of us children in the family and I have just had $40 spent on my teeth and now I have got to wait for a while." The fact is that in many instances the cost of the dental work now necessary to save the teeth would be prohibitive. Even slight attention to teeth also usually means absence from work and loss of pay. On completion of their examinations of the boys of a mill the examiners were usually asked by the agent or treasurer if they had any suggestions to make in the way of promoting the physical welfare of the employees. In response to such a request one treasurer was advised to secure the establishment of a well-equipped evening dental clinic in the city and he promptly acted on the suggestion.

Lungs and heart.—As indicated in the table, 21 of the boys had malformations of the chest sufficiently pronounced to be deemed worthy of note. So far as could be determined, all these malformations were congenital in origin. There was no case in which there was evidence of a former empyema. One case of pleurisy with effusion was discovered. This boy, robust in appearance, had been at work in the mill but two weeks and gave a history of a cold and cough beginning prior to his coming to his employment in the mill. At the hospital to which he was referred by the mill management, tuberculous infection could not be demonstrated. Eleven cases of slight acute bronchitis were found, all associated with the acute colds to which reference has been made in the foregoing. Not a single case of tuberculosis of the lungs was found. In four cases the physical examinations of the chests revealed symptoms which were deemed sufficient to warrant further investigation as to the possibility of tuberculous infection, but in all such investigation failed to confirm suspicions. While pulmonary tuberculosis would not be expected to be found very common among any individuals of the ages of those examined, there is a noteworthy absence of other evidence of tuberculous infection. There were no cases of actively inflamed or suppurating lymph glands, and but six instances in which there were scars from former disease of lymph glands. There was not a case of active disease of the bones or joints, whether due to tuberculosis or other infection. Except for two cases of deformity of the spine, presumably due to former Pott's

disease, there were seen no deformities of bones or joints which could possibly be attributed to former tuberculous infection.

So far as pulmonary tuberculosis is concerned, the absence of active cases among 679 boys, all under 18 years of age, few of whom had worked in the industry more than four years and nearly half of whom less than a year, is of little value as evidence in tending to indicate whether cotton-mill work predisposes to pulmonary tuberculosis or not. Of possible interest, however, in this connection there is inserted below a chart taken from a report on tuberculosis in the United States prepared by the United States Bureau of Census for the International Congress on Tuberculosis at Washington in 1908.

TABLE No. 18.—*Relative proportion of deaths per 100,000 of population from pulmonary tuberculosis among persons 10 years of age and upward in specified occupations, United States Census, 1900.*

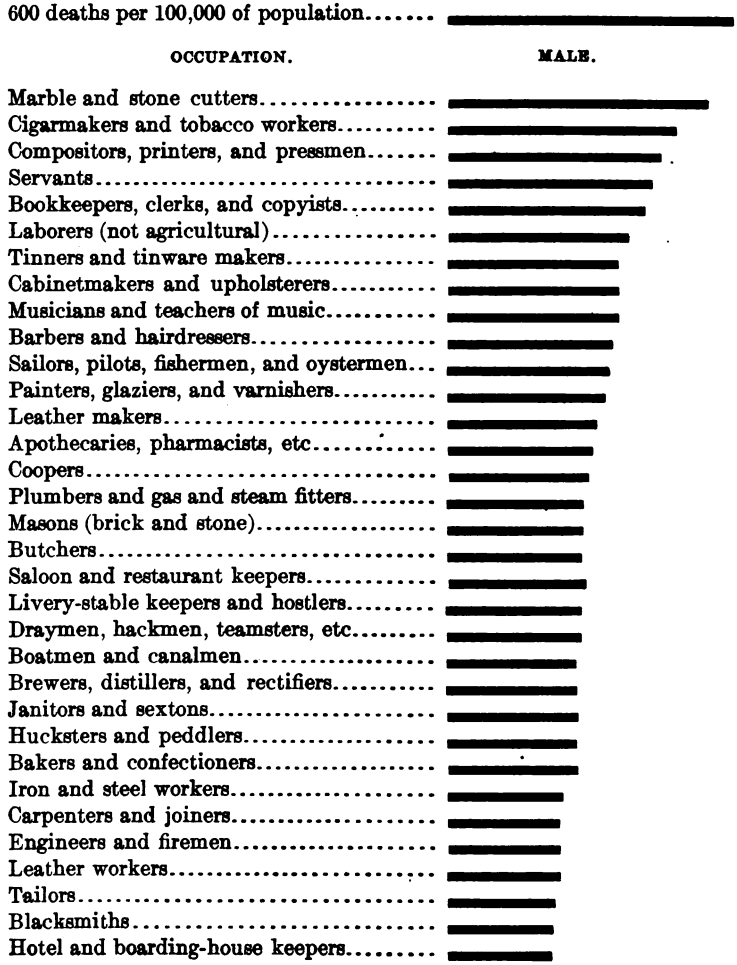
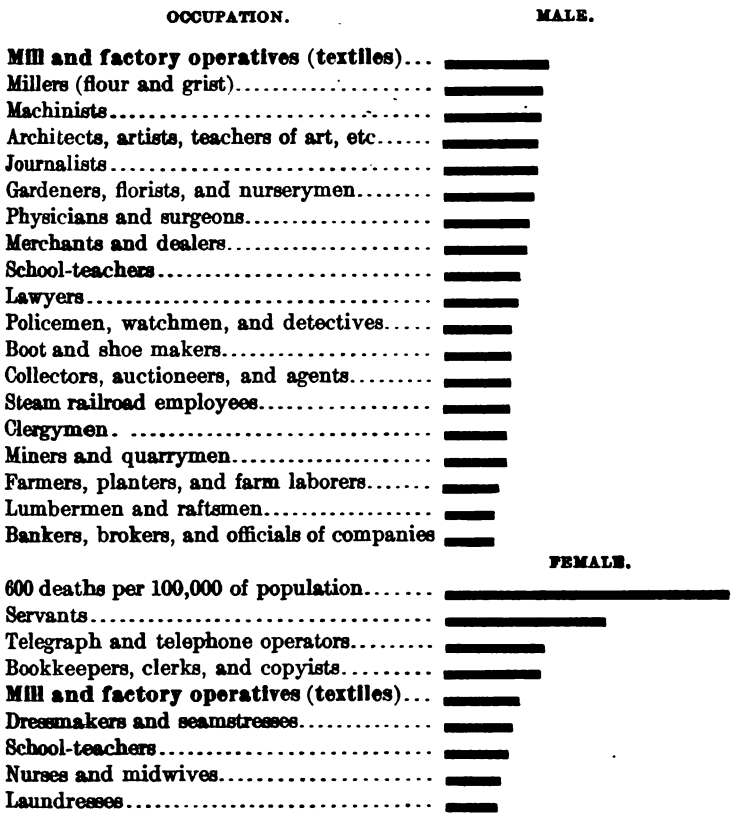


TABLE No. 18.—*Relative proportion of deaths per 100,000 of population from pulmonary tuberculosis among persons 10 years of age and upward in specified occupations, United States Census, 1900*—Continued.



Heart.—Three cases of organic disease of the heart were found, all as already mentioned associated with diseased tonsils. There was also one case of a subacute pericarditis found likewise in a boy with bad teeth and diseased tonsils.

Eighteen cases of functional disorders of the heart were found, six of them in one mill. The causes of these conditions can not be stated in all cases. The boys were not inclined to help out in a line of inquiry tending to reveal a possible cause in their own habits. In this investigation it soon became apparent that excessive use of tobacco was common among them, smoking both cigarettes and pipes outside the mill and chewing while at work. In none of these cases could excessive use of tobacco be excluded as a possible cause, and in a considerable number of the boys excessive tea drinking was admitted as well. One boy confessed to nine cups of "fairly strong" tea a day.

Anemia.—Notwithstanding the importance, in an investigation of this character, of an actual examination of the blood of an indivi

it was decided after careful consideration that an attempt to draw blood from a boy even to the extent of pricking the ear for a drop or two would be inadvisable in this State. In attempting to determine, therefore, whether or not a boy might be anemic recourse was had to devices made use of by officers of the Public Health Service in their line inspection of immigrants, the efficiency of which devices have been tested by subsequent actual examinations of the blood in thousands of individuals. While in the cases of some of the 34 boys noted as anemic in the table an actual blood examination would probably show that the inference as to anemia was unjustified, it is believed that 34 represents the maximum number of the boys whose blood by actual tests might possibly show a deficiency of hemaglobin or of red corpuscles which could be characterized as anemia. In practically all, if not all, the cases of boys credited as being anemic in the table other abnormal conditions sufficient to furnish a probable cause of anemia were also found present. It may be noted that, according to the table, out of the 220 employed in cotton mills less than six months, only 10 were credited as anemic, whereas of the 78 employed over three years 6 were so described. But it is also to be considered that 72 out of the 78 suggested no indication of anemia and that the whole investigation tended to indicate that boys who were physically weak were more likely to stay in the industry.

Glands.—Previous experience by officers of the United States Public Health Service in physical examinations of children had led to a belief that a perceptible enlargement of lymph glands in children would be found on careful examination to be more frequent than is generally supposed, and these examinations furnished an opportunity for making actual findings in a number of growing boys a matter of record. In every boy the bodily localties indicated were carefully felt and every perceptible enlargement of a gland was recorded. While, as already stated, no sign of a suppurating condition of lymph glands was found in any boy, the perceptible enlargement of cervical glands was in many instances associated with diseased tonsils. The prevalence of enlarged axillary glands, often as large as a large bean, and without any indication of inflammation, awaits an explanation. In no instance was there any condition about the fingers, hands, or arm to suggest a cause. It also appeared extremely doubtful if the enlarged epitrochlear glands possessed their usually accepted significance.

Skin diseases.—The freedom of the boys from skin diseases was remarkable. But one case of lousiness was discovered and only two contagious skin diseases were found, one a bad case of ringworm of the scalp (*tinea tonsurans*) and one a little ringworm of the face (*tinea circinata*). Four boys had isolated boils. There were 59 boys who showed some facial acne (pimples), certainly a small proportion con-

sidering the number of boys and their ages. The case of dermatitis of the hands, already alluded to, was evidently caused by a strong soap.

Rickets.—It is noteworthy that but one boy showed signs of former rachitis, as the hospital records of the cities in which the mills were located show that rickets must be a comparatively common affection.

Feet.—The feet of the boys were always carefully examined with view to the detection of any evidence of a strain from their occupation. But one case was found which could be characterized as flat foot, and even in this instance the boy denied that his feet were causing him any discomfort. The 22 cases of "poor arches of feet" noted were associated in every case with poor general physiques and indicated rather a weakness and probable source of future trouble than an actual present trouble.

The digestive system.—In the matter of food and digestion the apprehension of the boys as to possible motives of the examination made information which they supplied hardly reliable, but there was no instance in which the examiners saw reason to suspect that a boy might be suffering from lack of food. The instances of malnutrition seemed always much more probably due to malassimilation or some systemic poisoning. Objective symptoms of disease of the digestive tract were, however, absent except in the one case of suspected chronic appendicitis. The region of the appendix was invariably felt for signs of tenderness. In seven instances from various symptoms intestinal parasites, probably round worms (*ascarides lumbricoides*), were thought to be present. It is not believed, however, that infection with intestinal parasites was limited to these seven cases. It seems much more likely that intestinal parasites are really an important factor in accounting for the physical appearance of many of the boys.

Bursitis.—In one mill two "cleaners" were found to have a callous condition over the upper end of the tibia and indications of a bursitis about the patella, or in other words "housemaid's knee." It was not discovered in any other mill. As usual the boys affected were not very communicative. The overseer of the room stated that it was due to working on the knees and was a common affection in mills. "Bursitis" does not appear to be unduly prominent in records of hospital dispensary cases in cotton manufacturing centers, and whether "housemaid's knee" is an occupational hazard of the cotton mills still remains uncertain.

Nephritis.—Three boys were found to have chronic nephritis or Bright's disease. In each instance it can be definitely stated that the disease antedated employment in any occupation. It can be safely assumed that in each case the disease was produced by some systemic infection. In one case the history pointed with practical certainty to an attack of scarlet fever as the cause. In the other two

scarlet fever may also have been the cause. These two boys could not or would not give information to warrant a definite conclusion as to probable origin of the disease. But in these two cases diseased tonsils may indicate the source of infection.

The practical question arose as to what should be done with these boys, and the mill officials concerned turned to the examiners for advice. The circumstances of each case were considered. In each case it was apparent that discharge from employment would mean merely turning the boy loose in the street with no prospect of the medical or even parental surveillance that his condition called for. In each instance retention in employment meant an opportunity for constant medical supervision by the medical staffs of hospitals in which the mills concerned were interested and free bed treatment in the hospitals whenever symptoms might call for it. Retention in employment also assured keeping three cases of Bright's disease in a warm equable temperature for at least a large part of the time. The particular work at which these boys were employed seemed to be work which they would be well able to do whenever symptoms did not call for actual treatment in hospital. Under the circumstances the mill officials were advised not to discharge these three boys, but to refer them at once to the hospitals and, as to the future, to be governed by reports from the hospital staffs regarding the physical condition of the boys and their disposition to make use of the medical care at their disposal.

Temperature above normal.—Eleven boys were found to have a temperature above normal. In nearly all cases a cold or some other acute disturbance reported in the table was evidently the cause. In the remaining few cases in which a cause was not apparent from the physical examination the history indicated some acute illness of an unimportant character.

Mental defectiveness.—After a brief trial an attempt to subject each boy to the same systematic routine tests of mental capacity was abandoned as impracticable, for the reason that the nervousness of the boys under the physical examination and their suspicions as to its motives were found greater than was anticipated. The physical examination, however, gave an opportunity to engage the boys in conversation, and this conversation was directed in such manner in each individual instance as seemed best calculated to disclose deficiency in mental capacity. Evidence brought out in this way was confirmed by admissions of leaving school in the lowest grades because of inability to learn, even in some instances when put in "special classes," and of repeated failures to "hold jobs" after going to work. Many of the illiterates had not lacked opportunity to learn. It is believed that the 33 cases reported in which mental defectiveness was

suspected represents a very conservative estimate of the number of boys met in this investigation who would prove to be unquestionably mental defectives in a careful mental examination.

ATMOSPHERIC CONDITIONS OF THE COTTON FACTORIES.

In connection with the description of the various occupations at which the boys were found employed in the cotton factories, it was stated that, while in the cotton-manufacturing industry male minors might be found engaged in work dangerous to their health, so far as any boys encountered in this investigation were concerned, health hazards must be sought in the atmospheric conditions of the mills. Nor is there anything brought out by the physical examinations just discussed which seems to call for a modification of this statement. The actual examinations tend rather to lessen the probability of harmful atmospheric conditions. In most of the boys physically defective the physical examination itself revealed an apparently adequate cause in no way related to the occupation. But the possibility of atmospheric conditions in the mills unfavorable to health can not be ignored. Even if it be found that a growing boy shows congenital stygmata of physical degeneration, has rotten teeth and diseased tonsils, chews tobacco at work, smokes and drinks tea immoderately, swallows his midday meal whole to get more time to go swimming or to play ball during the noonday recess, and together with six other persons sleeps in a small room with the windows shut at night, it does not necessarily follow that there may not be something in the atmospheric condition of the mill also tending to make him look ill-nourished and pale. This whole investigation has tended to show that probably the majority of the boys examined compare favorably in physical development and health with any class of boys of the same ages from whatever environment they may come, but between individuals of the same ages striking contrasts in these respects were to be seen. While a careful study of the examination records of boys employed in mills of old and of new construction failed to suggest anything whatever of possible interest, it is a fact that marked differences in the air conditions in different mills visited did exist. It is also a fact that some individuals can apparently thrive in atmospheric conditions which to other persons are intolerable.

With the facilities at their disposal the examiners did not feel warranted in attempting to add to the voluminous experimental data which has been accumulated with respect to the value for breathing purposes of gaseous mixtures that have passed through the systems of other persons or as to the effect on bodily nutrition of varying degrees of temperature and percentages of relative humidity.

Effort was made, however, to secure some idea of the air conditions in the mills.

Dust.—As has already been stated, the opening of the cotton bales and the "picking" operations may be attended with the production of a good deal of dust of diverse origin. The "picking" process need not necessarily be dusty, and it was so safeguarded in some mills visited as not to be noticeably so. Aside from the opening and picking processes cotton manufacturing is not a dusty occupation, except for the fine cotton fibers or "fly" in the air. The floors are always more or less oily from drippings from the machinery. A certain amount of moisture in the air and freedom from strong dratfs are essential to the industry. Thus sweeping, even though it be done with ordinary brooms, does not seem to stir up much dust. Atmospheric cleanliness, so far as extraneous matter is concerned, is a recognized factor in cloth production.

It is now known that it is not the amount but the character of dust which determines its harmfulness and its ability to predispose to infection of the respiratory tract. Tuberculosis among soft-coal miners is remarkably infrequent, though their lungs may be found actually black from the coal dust they have inhaled. Other classes of miners, granite cutters, or others who constantly inhale dust containing hard, sharp particles of silicon compounds, or persons who inhale hard, sharp dust of other materials, can not hope to escape diseased lungs, even if they may escape tubercular infection. The fine cotton fiber so conspicuous in the air of mills appeared not to be so irritating as might be supposed. Collected by one of the examiners and placed experimentally in his eye, it produced but slight discomfort, and even this indication of irritant effect on the conjunctiva soon disappeared, apparently as soon as the cotton fiber became thoroughly moistened. This cotton fiber or "fly" was constantly found in considerable amounts in the nostrils of the mill boys, but was never detected any distance back in the nose. It does not on this account necessarily follow, of course, that "fly" might not get into the larynx or even the bronchi to a considerable extent. The boys could not be expected to breathe exclusively through their noses. Then, too, though uncommon, cases of defective nasal breathing were found. But moisture seemed to be a great factor in arresting the progress of cotton fly toward the lungs, and the respiratory mucous membrane of the boys was usually found to be noticeably moist, owing it was supposed to the tendency of the mill atmosphere humidity to check evaporation.

The mill dust does not, of course, consist exclusively of cotton fly; but in spite of colds and various abnormalities not possibly attributable to mill conditions, there still remained 499 out of the 679 boys whose respiratory mucous membrane showed no discoverable abnormality,

and this fact alone would seem to justify some doubt as to the harmfulness of ordinary cotton-mill atmosphere to the human respiratory apparatus.

Ventilation.—The mills visited included those of both modern and ancient construction. One of the largest was built prior to 1840, and there were several over 40 years old. In some mills or parts of mills of modern construction, a remarkable efficiency in ventilation had been attained. In all the older mills or portions of mills, comparatively recent efforts to improve ventilation were in evidence. The construction of some of these buildings made satisfactory ventilation a very difficult problem; but so far as giving opportunity for satisfactory ventilation, arrangements appeared to be adequate if intelligently utilized.

The automatic character of textile machinery insures a comparatively large floor space per operative in any room. Any tendency to jam more machinery into a room as machinery becomes more efficient is checked by the discovery that space for operatives about machinery and good light may give an equal production of cloth with less machinery. Even in the older mills of the average type the ceiling is sufficiently high so that, with the floor space required for machinery, a liberal initial cubic air space per capita of employees is practically assured. If ventilation, therefore, were a mere matter of the removal of second-hand air with its practically inevitable supply of pathogenic organisms and the furnishing of fresh air to human beings, the ventilation of cotton mills would be a simple proposition.

A fairly high percentage of relative humidity evenly distributed through a room, however, is essential to the conduct of the industry.[1] In the climate of Massachusetts for a large part of the time the outside air will not supply this requisite percentage of moisture for temperatures demanded for the comfort of indoor workers and the necessary humidity therefore has to be maintained artificially. But while a certain amount of moisture, varying somewhat in the different manufacturing operations, is necessary, on the other hand excessive moisture is bad. With either a deficiency or excess of moisture yarns begin to break.

With a high temperature a liberal supply of watery vapor can be assured and maintenance of a high temperature prevents the likelihood of saturation; so naturally there have arisen among mill overseers and operatives whims, notions, and prejudices as to what temperatures are necessary to make their work proceed satisfactorily. In cotton mills also there is a large amount of heat generated by the friction of the manufacturing processes. In one mill, in which conditions seemed to make estimates of heat from this source possible, it

[1] See p. 11.

appeared that the temperature of a spinning room was run up 10 or 15 degrees in the first hour after the machinery was started from this cause alone.

All the factors above referred to cause a tendency toward unnecessarily high temperatures and high relative humidity in cotton mills and a reluctance to admit outside air unless these matters be automatically controlled. In some of the newer mills this control is carried to the extent of having all air supply for a mill washed, heated in winter, or cooled in summer, and delivered properly moistened to the various rooms. The cost of an efficient system of this sort is very great, but in one instance in which information on the subject was available it would appear that the increased production of cloth per spindle for the mill made the cost of installation of the system a paying investment.

This matter of temperature and humidity in Massachusetts industries is made the subject of the following statutory law (ch. 543, sec. 5, 1910):

In every weaving and spinning department in a textile factory wherein water is introduced for humidifying purposes there shall be provided, maintained, and kept in correct working order, for the purpose of recording and regulating the humidity of the atmosphere and the temperature, at least one set of standardized wet and dry bulb thermometers, and, if required by (an inspector of the State Board of Labor and Industries) two sets of such thermometers: (*a*) The thermometers shall be placed as directed or sanctioned by (an inspector of the State Board of Labor and Industries), and shall be plainly visible to the workers. (*b*) The occupier or manager or person for the time being in charge of the weaving or spinning department in question shall read the thermometers thrice in the day, namely, between 7 and 8 o'clock in the forenoon, between 10 and 11 o'clock in the forenoon, and between 3 and 4 o'clock, except in rooms which are lighted by gas, and then between 4 and 5 o'clock in the afternoon of every day on which any persons are employed in any weaving or spinning department, and he shall record the readings of each thermometer in such department at each of the said times upon a form provided for the purpose, which together with the regulations relating thereto, shall be furnished by the State Board of (Labor and Industries). The records of the readings shall not be destroyed until they have been seen by (an inspector of the State Board of Labor and Industries) in whose district the factory is situated, and then not without his knowledge and consent.

Section 1 shall not apply to textile factories already equipped with, or which become equipped with, such a number and type of standardized self-registering hygrometers or psychrometers, or hygrometric system, as meet the approval of the State Board of (Labor and Industries): *Provided*, That the manner of using the same is approved by (an inspector of the State Board of Labor and Industries) in whose district the factory is situated, and provided that the records of the readings from the said hygrometers, or hygrometric system installed, are not destroyed without the knowledge and consent of said inspector.

Section 1 shall not apply to textile factories the occupier or manager or person in charge of which makes use of the sling hygrometer with the express purpose of quickly and accurately determining the actual moisture and temperature of a weaving or spinning department as frequently and in such a manner as is approved by (an inspector of the State Board of Labor and Industries) in whose district the factory is situated,

and provided that the records of the readings from the use of the said hygrometer are not destroyed, without the knowledge and permission of said inspector.

No owner, occupier, or manager or person for the time being in charge of a textile factory shall permit the relative humidity in a weaving or spinning department in the textile factory under his control to exceed the following limits:

TABLE 19.—*Limits of relative humidity.*

I	II	III	I	II	III
Dry-bulb thermometer readings.	Wet-bulb thermometer readings.	Percentage of humidity.	Dry-bulb thermometer readings.	Wet-bulb thermometer readings.	Percentage of humidity.
° *F.*	° *F.*		° *F.*	° *F.*	
60	58	88	78	73.5	77
61	59	88	79	74.5	77.5
62	60	88	80	75.5	77.5
63	61	88	81	76	76
64	62	88	82	76.5	74
65	63	88	83	77.5	74
66	64	88	84	78	72
67	65	88	85	79	72
68	66	88	86	80	72
69	67	88	87	80.5	71
70	68	88	88	81.5	71
71	68.5	85.5	89	82.5	71
72	69	84	90	83	69
73	70	84	91	83.5	68
74	70.5	81.5	92	84.5	68
75	71.5	81.5	93	85.5	68
76	72	79	94	86	66
77	73	79	95	87	66

While no effort was made in this investigation to compile exact data on the subject, it seemed probable that most of the boys examined in the autumn and early winter on clear, dry days were working in a mill temperature of about 75° F., with a relative humidity not over 70 per cent. As has already been stated, the work which the boys were found doing did not involve much physical exertion and, moreover, it was usually intermittent in character. These facts are, of course, material in considering the possibilities of temperature and relative humidity in interfering with the elimination of bodily heat. An effort was made to learn from more intelligent boys if they lost weight after beginning to work in the factories, but except in a few instances their testimony was negative, as well as was all other evidence coming within the scope of this investigation so far as the effect of temperature and humidity were concerned. The subject, however, appears to deserve more careful study than those engaged in this investigation were able to give it.

RECOMMENDATIONS.

Although this investigation did not happen to disclose any instances of the employment of minors engaged in work obviously injurious to health, it was nevertheless apparent that such instances are likely to occur. It was apparent also that injury to health may occur from

some change in the duties contemplated when the employment certificate was issued. It was evident from the physical examinations alone that there were boys whose interests from the point of view of physical welfare called for further attention after being permitted to go to work, whatever the work for which an employment certificate might be issued. To serve any useful purpose, such attention must be given with view to the needs of individual cases. It was also apparent that the economic possibilities of many of these boys and the interests of the State as well would be better subserved if they could be given more education than they had received.

While it does not appear from this report, it was learned that the great danger at present of improperly issuing employment certificates arises from the fact that those authorized to make the physical examinations are at times so overwhelmed by applicants that individual cases can not be given the attention they may deserve. Moreover, no physician whose duties do not bring him in actual touch with the occupations concerned can intelligently judge in many instances of the physical fitness of a minor to engage in the occupation. For the reasons above stated it is recommended that the authority to issue a working certificate to a minor be vested exclusively in some central State agency, a part of whose functions it is to know actual working conditions in any occupation in the State—such certificate to be issued on a formal prescribed application, calling for any information deemed desirable regarding the applicant and including the approval of the local school committee and evidence satisfactory to such central State authority of physical fitness as shown by a detailed report on a prescribed form of a physical examination of the applicant. Instead of having an employment certificate practically irrevocable as at present and attempting to safeguard certificates by care in the selection of a few authorized examining physicians, it is recommended that the central State authority may, if it deem advisable itself, and shall as a matter of course on request of the local school committee, limit the life of a certificate and make its reissue dependent on the reapproval of the local school committee and another physical examination. It is also recommended that the central State authority may accept a report on the prescribed form of physical examination of an applicant from any registered physician in the State, approved by the local school authorities, but that the central State authority shall have power to require that a report as to the physical condition of a minor applicant or a minor at work be furnished in any case or at any time by a medical officer in the employ of the State.

It is believed that changes in the present law to the effect just indicated would result in insuring a much better and highly desirable

control over the educational interests and physical welfare of minor wage earners in the State.

Except in the directions above indicated, it is not believed that this investigation has disclosed the need of any new industrial legislation. This investigation has, of course, been limited in its scope, but so far as it has gone the matters shown to be deserving of greater attention are rather matters awaiting the slow building up of an effective organization for carrying out already existing provisions of law. The prevention of the defective physical conditions disclosed by the actual physical examinations of the boys is a health problem rather than an industrial problem. To a certain extent there is the hard problem involved of helping mental defectives to make the most of themselves. The defective physical conditions found are to some extent the results of bad heredity and disease accidents in early life, but to a greater extent they reflect ignorance and neglect.

In this report reference to any specific locality or to any particular mill has been purposely avoided, but from data available it is possible to show that in some localities visited there is a civic spirit which has led to better care of the physical well-being of the population than in others. It takes money to preserve the health of any community, but without individual education of the proper character money spent for health purposes is largely wasted.

In the Philippines adults in the homes were educated in sanitation through instruction of children in the schools. Not only do the schools of Massachusetts offer the same opportunity to educate parents indirectly in child welfare, but the medical supervision of school children contemplated in existing statutory law of the Commonwealth offers the means of preventing directly much of the evidence of child neglect appearing in Table No. 17.

APPENDIX.

Form of Examination Blank Used in This Investigation.

MINOR'S EXAMINATION.

No..... Date.....19

Cert. No..... Name..... General occupation.....

(N. B. Read instructions before beginning examination.)

(A) Age.....Nativity.....Race....	Room.....Hours of work.....
Address.....	Special work.....
Present work, temporary, permanent, intermittent.	When and where previously employed....
Remarks:.....	Piece work.....Standing.....
.....	Posture.....Sleeping.....

(B) PHYSICAL EXAMINATION.

Cross out abnormalities not present.

Height.....without shoes.	General appearance, emaciated, healthy, anemic.
Weight.....without clothes.	Mouth breather; stutters; poor articulation. Face twitches; choreiform movements; has cough.
Dynamometer right hand.....lbs.	
Left hand.....lbs. Traction....lbs.	Vaccinated within five years.....
Physical development poor, fair, good, robust.	Remarks.....
Physically undeveloped for age claimed..	.....
.....	

(C) EYES.

Cross out conditions which can be excluded. If in doubt make (?)

What is the longest and shortest distance from the eye at which the minor can read this type?

Longest.....in.

Shortest.....in.

Vision for distance (Snellen's type): Right eye..... Left eye .....

Specify nature and extent refractive errors. Are refractive errors corrected by glasses?

Congestion.	Myopia.	Astygmatism.
Conjunct. ac.	Ptosis.	Unequal pupils.
Conjunct. Ch.	Cataract.	Phlyctenular ulcer.
Conjunct. Fol.	Keratitis.	Corneal opacities.
Trachoma.	Strabismus.	Color-blindness.
Blepharitis.	Nystagmus.	Hypermetropia.

Additional abnormalities and remarks:.....

(D) EARS.

Hears ticking of watch:	Excessive cerumen. Otorrhoea, chronic.
Right ear.....in.	Perforated drums. Otorrhoea, acute.
Left ear.....in.	Furunculosis. Polypi.
Hearing dull, normal.....	.....

Additional abnormalities and remarks.....

(E) NOSE, MOUTH, ETC.

Unable to breathe through right or left nostril.		Deformed palate.	Tonsils enlarged:
Rhinitis.	Deflected septum.	Pharyngitis.	Slightly.
Polypi.	Chronic catarrh.	Laryngitis.	Moderately.
Spurs.		Adenoids.	Greatly.

Mucous membrane mouth indicates anemia?.....
Lead line on gums.
Unclean teeth (M, missing; D, decayed; F, filled; A, artificial; O, out position; H, Hutchinson; R, Rachetic.) Upper jaw..... Lower Jaw.....
Tongue: Slightly coated. Badly coated. Fissured. Red. Scarred.
Additional abnormalities and remarks.....

(F) RESPIRATORY AND CIRCULATORY SYSTEMS.

Chest measure:		Heart:	Apex beat displaced:
Expiration.....in.		Irregular.	Downward.
Inspiration.....in.		Abnormally rapid.	Right.
Fine râles.	Consolidation. Cavity.	Intermittent.	Left.
Coarse râles.	Unequal expansion.	Abnormally slow, irritable.	
Pleuritic rubs.	Old empyema.		

Describe deformities.....
State diagnosis.....
Is sputum examination deemed advisable?.....
Murmur heard loudest at.....
Murmur transmitted to back.....
State diagnosis.....
Additional abnormalities and remarks.....

(G) SKIN, APPENDAGES, AND LYMPHATIC SYSTEM.

Enlarged glands:	Scalp:	Body:	
Occipital.	Pediculosis.	Pediculosis.	Acne.
Cervical.	Favus.	Ringworm.	Psoriasis.
Axillary.	Ringworm.	Eczema.	Paronychia.
Epitrochlear.	Eczema.	Impetigo.	Favus finger nails.
Goitre	Seborrhoea.	Furunculosis.	Dermatitis hands.

If other abnormal skin or gland condition or occupational dermatitis, describe it.

(H) BONY AND MUSCULAR SYSTEMS.

Active tuberculosis:	Round shoulders.	Knock knees.	Admits having:
Spine.	Kyphosis.	Bowlegs.	Hernia, varicose
Hip joint.	Scoliosis.	Flat feet.	veins.
Knee.	Lordosis.	Rachetic deformities.	

Malformation, mutilation hands or limbs, anchylosis, or lameness. Describe character and extent of disability.

(I) ABDOMINAL ORGANS AND INDICATIONS OF GENERAL DISEASES.

Abdomen:		Minor suspected to have:	
Epigastric tenderness.		Appendicitis.	Intestinal parasites.
Abdominal tenderness.		Gastric ulcer.	Nephritis. Malaria.
Protuberant abdomen.		Lead colic.	Diabetes.
Temperature by clinical thermometer (if indicated).....		Lead or chemical poisoning.	
		Blood, urine, Wassermann exam. recommended.	

Remarks.....

(K) NERVOUS SYSTEM.

Choreiform movements, tics, paralysis, describe. Test for anaesthesia and abnormal reflexes, if suspected.
Remarks.....

(L) MENTAL CAPACITY.

School education..... Illiterate.....
Is mental defectiveness suspected?.....
Remarks.....

(M) LABORATORY EXAMINATIONS.

Examination of sputum.....Wassermann reaction.....
Urine, sp. gr..... Albumen..... Sugar.....
Lead..... (test for lead if exposed to lead poisoning).
Blood HMG..... Red count..... White count.....
Differential..... Neutro..... Lympho..... Transit.....
Large mononuclear..... Eosinophiles.....

(N) PREVIOUS CONDITION OF HEALTH AND REMARKS REGARDING SAME.

Has had—Scarlet fever. Whooping cough. Tuberculosis. Measles.
Typhoid fever. Fainting spells. Diphtheria. Epilepsy.
Rheumatic fever.
Is subject to—Headaches—frontal, occipital, hemicranial.
Indigestion—chills, uses tobacco.
What accidental injuries?.....

(O) HOME CONDITIONS.

.....
.....

(P) ADDITIONAL INFORMATION, REMARKS, AND RECOMMENDATIONS.

.....
.....
.....M. D.

Assisted by—
.....
.....
.....

RELATED PUBLICATIONS.

[Literature bearing upon the subject of vocational diseases issued by the Public Health Service, fro which copies may be obtained without charge.

PUBLIC HEALTH BULLETINS:

No. 71. Studies in Vocational Diseases. I. The Health of Garment Worker By J. W. Schereschewsky. II. The Hygienic Conditions of Illumination in Work shops of the Women's Garment Industry. By J. W. Schereschewsky and D. H Tuck. August, 1915.

No. 73. Tuberculosis Among Industrial Workers: Report of an Investigatio Made in Cincinnati, with Special Reference to Predisposing Causes. By D. E Robinson and J. G. Wilson. April, 1916.

No. 76. Health Insurance: Its Relation to the Public Health. By B. S. War ren and Edgar Sydenstricker. March, 1916.

REPRINTS FROM THE PUBLIC HEALTH REPORTS:

No. 195. Industrial Conditions. Their Relation to the Public Health. By B. S. Warren. May 29, 1914.

No. 197. Industrial Insurance. Medical Examination of Employees and Pre vention of Sickness its Proper Function. By J. W. Schereschewsky. June 5, 1914

No. 234. Physical Examination of Workers. By. J. W. Schereschewsky. No vember 20, 1914.

No. 250. Sickness Insurance: Its Relation to Public Health and the commo welfare. By B. S. Warren. January 8, 1915.

No. 302. Industrial Hygiene. A Plan for Education in the Avoidance of Occu pational Diseases and Injuries. By J. W. Schereschewsky. October 1, 1915.

No. 335. Statistics of Disability. A Compilation of Some of the Data Available in the United States. By B. S. Warren and Edgar Sydenstricker. April 21, 1916.

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IMPOUNDED WATER

SURVEYS IN ALABAMA AND SOUTH CAROLINA DURING 1915 TO DETERMINE ITS EFFECT ON PREVALENCE OF MALARIA

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IMPOUNDED WATER.

SURVEYS IN ALABAMA AND SOUTH CAROLINA DURING 1915 TO DETERMINE ITS EFFECT ON PREVALENCE OF MALARIA.

The investigation of the effect of impounded waters on the incidence of malaria, begun in 1914 and reported in the Public Health Reports,[1] was continued during 1915. Surveys were made of the following bodies of water: The pool of Lock 12 on the Coosa River; the pool of Lock 17, Black Warrior River; the pond of the Parr Shoals hydroelectric power plant; and the pond of the Georgia and Carolina hydroelectric power plant at Stevens Creek. The first two are in Alabama and the last two in South Carolina. In addition, a cursory survey, but sufficient for the purpose intended, was made of two ponds of water of the Tennessee Coal, Iron & Railroad Co. near Birmingham, Ala. Incidental to other work a survey was also made of three small ponds in Virginia. Practically this was a physical survey, as it was too late[2] for the biological survey to be satisfactory, though such a survey was carried out so far as practicable.

It had been planned to make surveys of typical areas showing the following conditions:

(1) An area to be covered, but as yet not covered, by a large pond and its environment, the dam to make the pond being in process of construction (or soon to be constructed). Comparison of this survey of the locality in its natural condition, with subsequent surveys after the pond was filled, would give exact data on the change in conditions produced by the pond.

(2) A pond in its first year.

(3) A pond in its second year.

The last two were to be selected in environments as nearly alike as obtainable, and these surveys were intended to determine the change in the pond from the first to the second year, as there was some reason to believe that this change might be considerable. Three suitable units were selected in Alabama.

A physical survey of the ponds at Parr Shoals and Stevens Creek in February, 1915, however, had shown that they presented some

[1] Reprints No. 244, 248, and 257, U. S. Public Health Reports. [2] October.

unusual features and that a biological survey of them was immediately advisable to determine the existing conditions,[1] and especially to enable us to give advice to correct certain insanitary conditions which it seemed very probable would obtain about portions of them. The survey of the area to be covered, but not yet covered, by the impounded water contemplated under (1) was therefore postponed and that of these two ponds taken in its place. This was the more advisable, as, owing to industrial conditions, the site selected for this survey would not be covered by water for at least two years.

SURVEY OF PONDS IN ALABAMA.

In order to examine the pond under different conditions of season, water, etc.,[2] two surveys of the pool of Lock No. 12, Coosa River, were made, May 28 to June 25 and August 18 to September 19. The power plant and Talladega Springs were used as bases to work from in both surveys and a power launch was used to reach the different parts of the pool. The actual work was done on foot or in a canoe.

This pond was in its second season, having been filled in June or July, 1914. It had been the object of quite a thorough survey by Le Prince and Donley during October and November, 1914. In our June, 1915, survey it was examined by "sampling." All creeks and large branches were examined up to and beyond backwater, and portions of the banks of the main pond and of the bayous caused by these affluents were selected in different places and examined thoroughly. Large numbers of sample banks were examined and pains taken to select those that would be apt to breed or shelter *Anopheles* larvæ. Some places were examined more than once at intervals of from four days to a week.

In the survey made in August and September a few localities believed to be fairly typical were examined carefully, and more than once. The survey was an intensive study of such type places, and no attempt was made to examine a great number of places, much less the whole pool, which has a shore line estimated at from 90 to 120 miles. Some examination was also made of territory beyond the influence of the pool. This work was fairly complete, and the state of the pool, as affecting malaria incidence for this year, can be given with a fair degree of accuracy.

The survey of the pool of Lock 17 on the Black Warrior was not attempted on the same scale as was that of the Coosa pool. It would have required the entire summer to do so, and the information gained would have been less than that which the same time spent elsewhere would give. We spent from June 27 to July 17 on this pool and

[1] They were filled in June or July of last year.

[2] See Reprint No. 244 from Public Health Reports, p. 12.

examined three sections of it: (*a*) Using the lock as a base, from the lock up for 6 miles on both sides and in every inlet and up every creek (except one) and branch to the head of backwater and some distance beyond; (*b*) using Maxine and a farm house on Prescott Creek as bases, the whole of the Locust Fork of the Warrior up to Short Creek and its affluent creeks and branches; (*c*) using Cordova as a base, the upper part of the pool from about 6 miles above Cordova to about 4 miles below.

The examination from the lock was made under normal conditions and was in every sense satisfactory. Unfortunately the work at Maxine was coincident with a sharp rise, from 4 to 6 feet in this part of the river, and was by no means satisfactory. At Prescott Creek the same condition prevailed to a less extent, but we took unusual pains to determine the condition of this locality, putting 3½ days on this single creek and the work here, although hampered by the high stage of water, was fairly satisfactory. When we reached Cordova the water had fallen nearly to normal, and examination of the pool itself, allowing for the effect of the recent fall, was reasonably satisfactory. That of the affluents above backwater was not, as they had been scoured out by the recent rains.

We found it convenient to consider the waters examined under five heads: (1) The pond itself, the main open body of water; (2) the small bights (or bays) of the pond; (3) the bayous at the mouths of creeks and branches;[1] (4) the dead water or backwater of the creeks and branches. This is from the head of the bayou up to the free running water of the creek. It is practically still water, but is all within the creek banks. The bayou is out of the creek banks; (5) live water of creeks and branches where the water is running as freely as before the pond was made. In addition there were marshes, pools, etc., caused by the pond, but outside of it, and similar ones not caused by it.

POOL OF LOCK NO. 12, COOSA RIVER.

JUNE SURVEY.

Physical condition.—The rise of water is about 63 feet and the backwater extends for 25 miles. It was closed in the summer—June or July—of 1914. For the lower 5 or 6 miles up to the Narrows the river runs in a gorge, and the banks of the pond are against the bluff on each side, there being no wide spreading out except in the bayou of Paint Creek. The country adjacent is wild and sparsely

[1] The bayou for any creek is the part of the pond filling the valley of the creek which is deep enough to overflow the former banks of the creek. Bayous and bights differ only in degree, but the latter are usually so much more open to wave action that the breeding conditions may be essentially different.

settled. Above this the land is lower and the pond spreads ou widely over low grounds, especially about the old mouths of creeks— Slaughter Creek, Spring Creek, Cedar Creek, etc.

Paint and Waxahatchie Creeks, coming in below the Narrows, an Slaughter, Spring, Peckerwood, Beeswax, and Bullace above th Narrows, are all large creeks, Waxahatchie and Cedar especially s

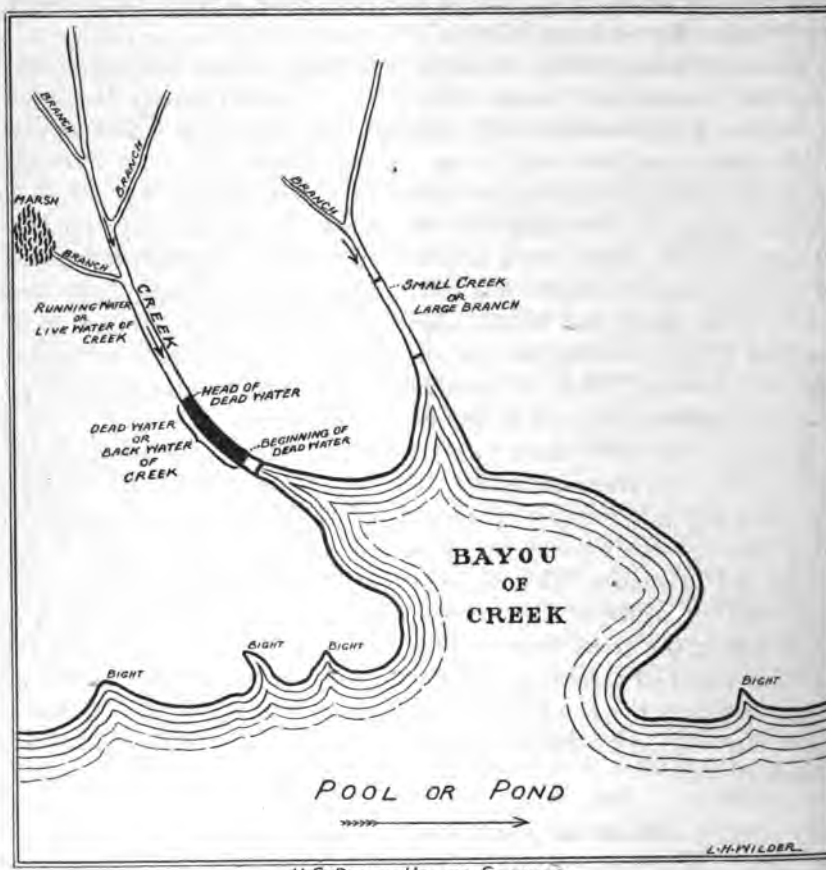

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Fig. 1.—Representative creek, bayou, and pond. Pool is the term used by the United States engineers for the water impounded above a lock for navigation. Note that creeks and branches differ only in size.

All except Waxahatchie and Bullace have large bayous coverin many acres. Waxahatchie runs in a gorge in the lower part of i course and Bullace is so far from the dam[1] that the water is n raised high enough there to make a large overflowed area.

In spite of the rise of the bed of the normal river, the pond much wider above the Narrows than below. The country above th

[1] About 20 miles.

Narrows is more level and more thickly settled than below. In places it is a fairly good farming country. There is little stowage of water, it running freely through the weir—and consequently more floating stuff goes past the dam than one would expect in a pond

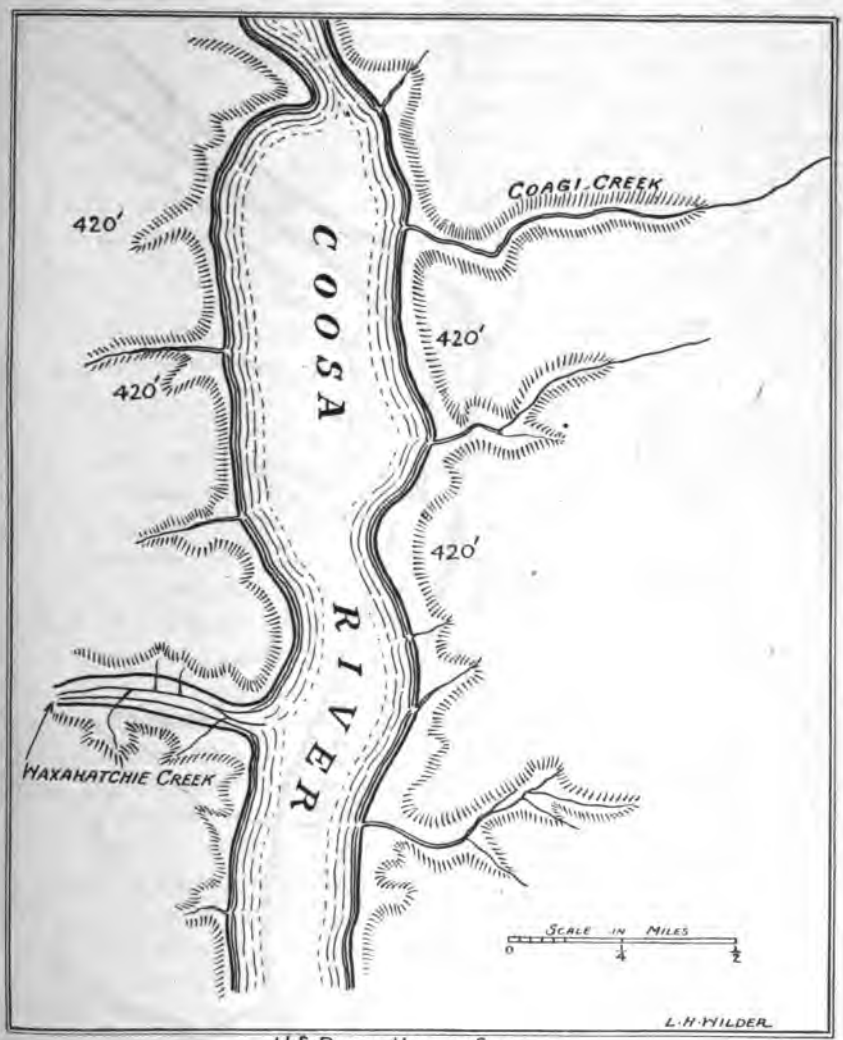

Fig. 2.—Section of pool of Lock No. 12, Coosa River, below the Narrows. Outer hatched line is 420-foot contour. Inner line is old line of Coosa River. The Narrows is about 4 or 5 miles above dam. Elevation of water here is about 59 feet.

of this size. Nearly all of the trees and brush were cut off the pond before the water was turned in. Over some of the areas this material was removed by hauling off or burning, and over others this was not done, or incompletely done.

This is a constant level pool. There is no necessity for its being so, but the impression has got abroad that variation of the water level is productive of malaria, and to prevent this the power company raises the gates whenever a flood is expected and closes them

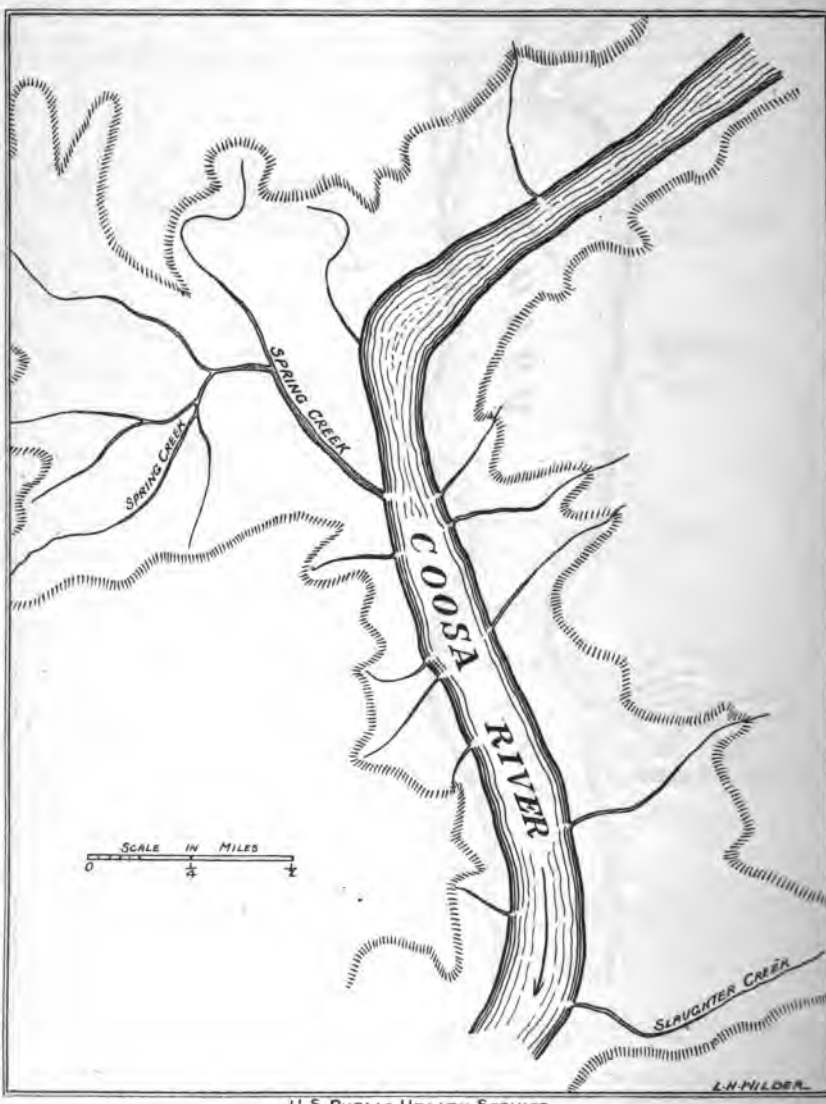

Fig. 3.—Section of pool of Lock No. 12, Coosa River, above the Narrows. Elevation of water a little less than in figure 2, yet section overflowed by pool is greater. Water here is raised about 43 feet, the map covering the area from 7½ to 10 miles above the dam.

when it has passed. As the flow in the river has been in excess of the requirements for power, the company has been able to keep the level very nearly on the 420-foot contour during the summer and

fall. Consequently, there is minimal stranding of drift and flotage due to change of level during this part of the year. Fortunately rises will take place during the rest of the year, and a large quantity of flotage and drift was landed up on the bank during the spring rise.[1]

In spite of this constant level there was only a very small amount of flotage on this pool during the June survey. There were practically no pine needles, which had been so abundant the previous fall, and leaf flotage was absent, except in a few creeks. The cutting out of the trees of the pond has to this extent been an advantage.

A large amount of drift comes down the Coosa, and this, with such logs of the cut trees as were not removed, formed hummocks in some places. It is surprising, however, how few such collections of logs there were.[2]

The water was mainly clear. During the June survey algæ were not present in sufficient quantities to be a factor in the breeding of mosquitoes.

Biological conditions.—The June survey also showed one thing very clearly, viz: The pond furnished few, if any, breeding places of sanitary importance for *Anopheles*. In the body of the pond (including bayous of affluents), they were practically not found. In the backwaters of creeks they were found almost exclusively just below the head of backwater, and in such cases in the running water higher up and in the pools and marshes on the sides of running water they were always breeding, and breeding more freely than in the backwater. The evidence was all in favor of these latter being washed down from above. This was true of Paint, Cmgl (very few), Beeswax, and Bullace Creeks. When the running water or the small marshes close to the sides of the creeks were not breeding, larvæ in numbers to be of sanitary importance were not found in the creek below it. The great majority of the breeding about the pond at this time was in the live (running) water above pond level and in the marshes adjacent thereto, and that in the pond was almost confined to the affluents about the head of back water. It must be noted, however, that even if the larvæ found in the back water of creeks were washed down (as eggs or larvæ) from live water above the pond level, yet the pond should be charged with the production of a certain proportion of the progeny of mosquitoes which have given there, as a proportion of the larvæ which lodged in the backwater would have been washed further down and drowned and the pond not been in existence. This must be borne against the production

[1] By drift is meant floating [illegible] all floating material, but mostly stranding stuff. (See Reprint, U. S. Public Health Service [illegible])

[2] The writers have notes of only [illegible] collections of logs

which would have normally taken place in the part of the affluent now covered by the pond and not now producing.

Larvæ were observed away from the bank in Cedar Creek on leaves and small trash floating in the water. This was on June 18. Two days before there had been a heavy rain on the upper part of this creek, which is very large and long, and both above backwater and for nearly a mile below its head, larvæ of all sizes were found on this floatage, adrift in the stream, against the bank, or adhering to branches of trees that dipped down into it. The lower part of the backwater of the creek and the bayou below it were free from this floatage, and although careful search was made, only a very few larvæ were found against the bank in the former and none in the latter. In the backwater they were fairly abundant, especially high up, and because of the large area involved, comprised a large number. They were of all sizes.

On June 24 another trip was made to this creek to observe progress. It was practically bare of larvæ below live water either on floatage adrift or on the banks; nor were any found in the bayou below, where we naturally expected them to have been washed out. Their disappearance was ascribed to fish control, as a large number of small fish were seen in this creek on both visits—although on account of its depth and steep banks it is not a favorable place for minnows. Leaf floatage was not common on the affluents of this pond in June, except on Cedar and Waxahatchie Creeks, which are very long streams.

As Cedar Creek was a surprise to us in one way, so Slaughter Creek Bayou was in another. The shore around a part of this bayou was apparently an ideal place for producing mosquitoes, as it was marshy, with a number of small pools—cow tracks mainly—some covered by grass and some exposed to the sun. This was examined twice in June (14–15 and 21). On June 14 and 15 a few small Anopheles larvæ were found—too small to develop. Seven days later—when they should have been good sized—a careful search showed practically none. Many of these pools contained water boatmen, but not all of them. Possibly these small pools were too hot—the temperature of the water is recorded June 21, 9 a. m., as 86° F.; 10.30, as 92° F.; 1 p. m., as 96° and 98° F. The thermometer was shaded (with two hats) from the direct rays of the sun. It was a common bath thermometer and only approximately correct. This place was barren of larvæ at the survey on August 22 and 28, but a few larvæ were found in the bayou offshore in water 8 to 12 inches deep, where live grass hung over into the water. They were not enough to be of any sanitary importance. None was found in the dead grass. There was quite a number of Culex larvæ seen at both examinations.

Conclusions.—Anopheles larvæ during this June survey were abundant in the live water of small streams and in marshes and pools adjacent to them, but were practically not found in the pool, except in the dead water of creeks under conditions which implied that they were washed there from above.

Practically all of the larvæ developing into imagos from this June collection were *A. punctipennis.* Of about 600 Anopheles imagos developed two only—from the Slaughter Creek section—were *A. quadrimaculatus.* The same distribution of species—101 *A. quadrimaculatus* to 1,152 *A. punctipennis*—had been found in the survey of November, 1914. Of these *A. quadrimaculatus* all except 36 were found in one place—Paint Creek Bayou. In the latter part of May some imagos (all female) of this species (*A. quadrimaculatus*), were taken in the guest house at the power plant. A careful search by LePrince and Carter was made for their breeding places. Imagos were developed from every collection of Anopheles larvæ we could find within a mile of this house. All were *punctipennis.* It is always possible to miss a breeding place, but careful search was made[1] and it is thought that possibly these imagos might have hibernated from the previous year, especially as this form was not found developing from larvæ in this section for nearly a month later.

AUGUST AND SEPTEMBER SURVEY.

This survey was begun August 18. A 3 or 4-inch rise of the pool had just occurred. Small as this rise was, it sufficed to strand a great deal of floatage. Where the banks were gently shelving, this was left well above the water and such banks were clean of floatage.

The biological condition differed markedly from what the June survey had shown. As at that time, the live water and side pools and marshes adjacent to it were swarming with *A. punctipennis* practically in pure culture and many more than in June. The pond water, however, showed along with *A. punctipennis* a preponderating proportion of *A. quadrimaculatus.* In some bights, hammocks of drift had lodged. Where fine floatage and algæ were mixed with this, larvæ were found and at times in numbers. Thus in the bayou of Sulphur Creek near Talladega Springs many patches of fine floatage had lodged against brush standing in the water, against logs, etc. On these patches algæ were growing, and larvæ were sheltered in practically all of them. The distribution of these two species of Anopheles can not be better illustrated than by this place. In the live water of the several branches of this stream and in the marshes feeding into them, the larvæ of *A. punctipennis* were swarming. Only in one "pot hole" on a small branch did we find any *A. quad-*

[1] The search lasted for two days and two half days.

rimaculatus above the bayou: 2 *A. quadrimaculatus* out of 28 Anopheles. The "backwater" of the creek was practically barren, and no Anopheles larvæ of any kind were found except at the upper end. The bayou yielded both species, but with *A. quadrimaculatus* heavily predominating.[1] Some bights on the shore line of the pond just above this bayou, in which hammocks had lodged, showed the same picture.[2] In general a somewhat larger proportion of *A. punctipennis* were found in the pool water than at these places, but except in Cedar Creek we practically did not find, in the vicinity of the pond, *A. quadrimaculatus* mosquitoes in live water of streams, in marshes, or in small pools. They were found only in the pond itself and in pools which were of some size, as in a large pool up Spring Creek and a concrete tank at Talladega Springs. Our records show over 1,600 imagos developed during the August and September survey in addition to 600 or 800 *A. punctipennis* sent to the laboratory. These are enough to base a judgment on.

In the upper part of the backwater of Cedar Creek, larvæ were found in leaf drifts. No Anopheles larvæ were found in the lower half mile of backwater and practically none in the bayou of this creek, except on the north side one-quarter mile from the mouth. *A. crucians* were found here in bait holes,[3] as were the other two species.

Factors determining breeding.—The breeding in the pond at this time was decidedly irregular in amount. The factors which seem to have determined the breeding were such as give protection to the larvæ and possibly furnish food for them. They were not found where subject to wave action nor where fish could readily get at them. On the other hand, where a collection of drift in front of a bight protected it from wave action and sheltered a mass of floatage with living algæ in it, they were frequently found. In the pond they were found more often in water over 2 feet deep than in shoal water. Possibly this is because of the presence of fish. They were rarely found except in floatage, usually fine floatage with algæ or leaves; heavy drift did not seem to be sufficient. On the gently sloping edges of the pond they were practically absent. They were much more common against a steep bank, if material to shelter them was lodged a little way from it, as was common in bights with steep banks. The gently sloping edges were free from floatage, since the rise of the water level, small as it was, and wave motion had stranded the floatage ashore.

Why larvæ were so rarely found in the backwater of creeks is unknown. This zone, except the upper part, was usually barren,

[1] Two *A. punctipennis* to 14 *A. quadrimaculatus* is one record; 21 to 120 is another.

[2] *A. punctipennis* 0, *A. quadrimaculatus* 24, is one entry; *A. punctipennis* 2, *A. quadrimaculatus* 60, another; and *A. punctipennis* 8, *A. quadrimaculatus* 64, yet another.

[3] These are holes made by digging for angleworms. They were filled with seepage water.

although *A. punctipennis* might be above in live water and *A. quadrimaculatus* below in the bayou.

The breeding was profuse in patches, but there were large areas without larvæ. Some of these places seemed to be physically well suited for breeding and no reason was apparent why breeding was not taking place. There was more production within a mile of Sulphur Creek bayou than we found in the same area anywhere else. Indeed, in only a few other places, as at the mouth of Coagi Creek bayou, south side, in some bights of the lower Waxahatchie, and in a small place in Cedar Creek bayou were larvæ found in even considerable numbers. We did not go into every bight and creek of the pond, but a fairly close survey was made from Cedar Creek to the dam. There was a large water weed growing on logs, hammocks, etc., and along the edges of the pond, with a big bunch of white roots which reached down into and floated about in the water. Never did we find larvæ among these roots, even when some floatage was adhering to them. The same weed and same absence of larvæ were seen in the two ponds in South Carolina. Larvæ were not found in grass recently dead and rotting. Aquatic vegetation, except algæ, is not a factor in mosquito production in this pond at present. On the contrary, algæ were found to be a prominent factor in the August and September survey. Minnows were not generally abundant in this pond. In some places good schools of them were seen, but they were not common. Yet larvæ were practically absent unless protected by floatage or other cover. Minnows were decidedly more abundant than in 1914.

Species of Anopheles in fall.—As *A. quadrimaculatus* was practically not found in this pond during the survey of October and November, 1914 (except in one place on Paint Creek), nor in the June survey of this year, but was the most common form found there during the survey of August and September, it seemed desirable to see if it again disappeared in advance of *A. punctipennis* in the fall. One of our party (Griffitts) therefore returned to Talladega Springs October 26–30. The weather, however, was reported as having been unusually warm for the season. Dipping Sulphur Creek Bayou, Rock Spring Bight, the Bait Holes, and other places in the pond which had given such a high percentage of *A. quadrimaculatus* (88 per cent), he found:

	Per cent.
A. punctipennis	71
A. quadrimaculatus	19
A. crucians (from "Bait Holes" as before)	10

Evidently the ratio of the species had changed, and the evidence was that this was due to the diminution of the *Anopheles quadrimaculatus*.

Malarial fevers.—Malarial fevers were reported as having been very prevalent in the neighborhood of this pond in 1914, and we saw houses that had been abandoned on this account. The survey in June gave no reason to believe that the pond was a considerable factor in the production of Anopheles mosquitoes, but the second examination did. In some parts of it the breeding was prolific. These, too, were mainly *A. quadrimaculatus*, a well-known malarial vector. The production of a considerable number of this species within the distance of flight from residences might be a decided factor in producing malaria.

We were told about the middle of August that there was less—some said much less—malaria in the country in this vicinity in 1915 than during the previous year. If true, this may have been due, so far as this pond is a factor, to the abandonment of houses in the most unhealthful locations or to a change in the biological condition of the pond. Excepting Sulphur Creek Bayou and its environment, we found breeding of sanitary importance in but few parts of the pond close enough to residences to be a menace to their inmates.[1]

A search for mosquitoes in houses, residences, and outhouses was made at the village of Talladega Springs, Fayetteville, and Shelby, and at the Lock 12 power plant, Kytles Mill, and in a certain number of other houses in the country. The findings were interesting, but do not seem entirely pertinent to this paper. One conclusion reached from them is that *A. quadrimaculatus* from Sulphur Creek Bayou visit residences in greater numbers in the parts of Talladega Springs closest this breeding place. In the other parts of the village not more of this species were found than were found in Shelby, 4 to 5 miles from the pond, or in houses in the country far distant therefrom.

RECOMMENDATIONS.

Although the investigation of impounded waters has not advanced so far that we can make definite recommendations for the prevention or removal of all remediable conditions, yet we felt justified in making to the power company owning the Coosa Pond certain general recommendations to lessen the mosquito production therefrom. These were:

(1) That they keep the level of the water as high as their flowage rights will allow during the season when the pond is not producing *A. quadrimaculatus*—i. e., from about October 1 to June 15 or 30—and lower it for the three summer months.

[1] So far as the year 1915 is concerned it seems proper to say here that the weather in late August and September was ideal for Anopheles production over much of the South and that malarial fevers were unusually prevalent in many sections reported to the writers from Virginia to Georgia, inclusive, and over North Alabama. There had also been much fever in Talladega Springs to the latter part of September. It is doubtful, then, if the section under discussion escaped.

This will (*a*) kill the brush and land vegetation up to the high level, and (*b*) land the floatage and much of the drift on the bank at a level where it will be left when the water falls. Both will help to give clean banks during the breeding season, open to both wave action and fish.

(2) To save the rises that come in the summer as much as possible, so as to give as much variation as possible to the level during this season.

High water will be transitory and low water the rule during this season. There is no chance that it will ever get up to the winter level and stay there long enough for the imago to develop from the egg.[1] The effect of this varying level then will be (*a*) to land such floatage as accumulates in the summer, and (*b*) to render many larvæ more accessible to fish by compelling them to move from their shelters or setting their shelters adrift or stranding them. It is believed that if these measures are carried out the breeding of mosquitoes in the pond will be materially lessened.

Some special measures were also recommended for Sulphur Creek bayou and the bights adjacent, and the authorities were advised to introduce as many mosquito-eating fish as possible, the preference being given to *Fundulus notatus*, *Gambusia affinis*, and the smaller sun fish, especially the first mentioned. For that purpose the authorities were put into communication with the United States Fish Commission.[2]

BLACK WARRIOR, POOL OF LOCK 17.

JUNE-JULY SURVEY.

Physical condition.—This dam raises the water about 63 feet. The pool extends to about 7 miles above Cordova on one fork (58 miles) and about 6 miles above the Maxine mine on the other (11 miles, or 69 miles in all). One creek—Yellow Creek—is navigable.[3] The pool of Lock 17 is thus quite large. There is no interference with its level artificially, as it is for the improvement of navigation, not for power, and the freshets rise normally, raising the pond level, which in low water falls to the level of the top of the dam. It would naturally, then, be higher in winter, spring, and early summer than in the fall and would thus tend to have clean banks at the water's edge in the late summer and fall, unless brush holds the floating stuff away from the bank and prevents its landing.

The dam was closed about the first of the year (Dec. 26, 1914). No clearing or preparation of any kind was made for the site. For

[1] For this about 16 days would be required.
[2] Fish of some kind has been put in, but of what kind we are not informed.
[3] Seven feet of water for 8 miles.

nearly all of the first 20 miles, counting from the dam, the pool lies against high bluffs with steep banks, frequently of sheer rock. Only where ravines and water courses enter are the banks at all sloping. Even the mouths of large creeks give no perceptible width to the pool. The creeks themselves run in gorges. About the fork, however, there is considerable level land overflowed in a broad area at the mouth of Prescott Creek. The bayous of the creeks above the fork, as high as Frog-Ague Creek at Cordova, are frequently broad and cover considerable area.

Naturally in a pool of the character of this one below the fork, there would be little accumulation of drift, except that which came out of a creek and stopped about its mouth. This was what was found. There was, however, a great deal of "leaf floatage." Many of the partly submerged trees were dying, and they dropped their leaves in the water. These gathered in the heads of bayous of creeks and in some bights. There was also about the heads of some bayous a lot of fine floatage, which apparently had been washed down the creeks and floated up from the flooded ground. There was much more floatage of the above kinds than on the Coosa, but far less of heavy drift. There was such drift, however, in Prescott Creek Bayou and in some of the bayous near Cordova.

Biological condition.—The biological condition of that part of the pool next to the dam differed from that found at the Coosa pool. Quite frequently we found complete breeding places for anopheles in the pond about the heads of bayous of branches.[1] Anopheles larvæ were found in leaf floatage, especially among the small leaves of the beech and pine needles, but also in the fine floatage collecting at the heads of some bayous. In some places they were breeding profusely, more so than had been found in any pondwater on the Coosa. Where there was little floatage there were no larvæ, although the converse was not true. The majority of such bayous and bights showed no breeding, or very little. The same was the case along the open bank of the pool. The affluent streams were not breeding heavily in live water. There were two exceptions to this: Big Indian Creek, below the dam, and the headwaters at Hollman's branch, entering above the dam.

Of the 100 larvæ developed here all were *A. punctipennis*, except four *A. quadrimaculatus*. Small fish were very abundant in some places; in many others entirely absent. Apparently they had not had time since the filling of the pool to spread all over it. Indeed, the rarity of shallows, etc., make it a pool not very well fitted for minnows, and the total number seen was not large.

[1] By a complete breeding place is meant a place in which the imago develops from the egg deposited at that place.

The same biological condition doubtless prevailed in the upper reaches of the pond. These, however, were visited during and just after a sharp freshet, and allowance had to be made therefor. About Cordova we found the same collecting of larvæ in fine and leaf floatage which we found below; but we found it in fewer places, probably due to the freshet. In two live-water streams examined, one in the town of Cordova, a large number of larvæ were found.

Only a small number of larvæ were saved from pond water here, and owing to accident, not enough of them hatched out to make a counting. Those from the stream in town were *A. punctipennis*, and 150 were developed up to July 15. At Prescotts Creek bayou larvæ were found attached to fine floatage and leaf floatage anchored to limbs of trees, logs, etc., out in the bayou. Some of them were evidently washed out of the main creek by a heavy rain and flood; others, we believed, developed in situ. The basis for this belief was: (1) The presence of larvæ of all sizes, and (2) their occurrence in places to which it would be impossible for larvæ to wash. Schaudinn is quoted as saying that Anopheles larvæ are not found in water over 1 meter deep. Here (and elsewhere) we found many of them in water over 6 feet deep. The water on this flat, however, was mainly shallow—from a few inches to 3 or 4 feet deep. It covered many acres and the total breeding was large. Larvæ were found only in floatage away from the banks; none was found next to the banks, which were gently sloping and free of floating shelter, although they had grass on them. At this place, up to July 9–14, much of the hatch was *A. quadrimaculatus*. The water here (Prescotts Creek Bayou) was mainly shallow, still, and fairly exposed to the sun. Algæ did not seem to be a factor in breeding anywhere in this pool at this time.

SEPTEMBER AND OCTOBER SURVEYS.

A survey was made close to the dam by Griffitts, September 17 to September 21, inclusive, simply to see if *A. quadrimaculatus* had appeared in the pool, as was the case on the Coosa. The pond was at its lowest, and the water clear at this time. Little floatage was found on the pond; the banks were clean, because the pond had been high and had stranded the floatage on the bank and then fallen.[1] Wherever there was floatage, larvæ were found. Fish were much more abundant than in June.[2] There were very much fewer larvæ in the

[1] Griffitts notes that most of the floatage observed at the survey in June must have sunk, as from its location it could not have been washed away and less was stranded on the bank than was present in June. Leaf floatage, which comprised by far the bulk of what was seen here in June, stays afloat but a short time—days only. The same is true of pine needles. Fine floatage does not sink quickly, and bound together with algæ, it may float a long time.

[2] One identified as *Fundulus notatus* was taken.

pool than there were in June. The same two streams which were breeding in live water in June were still breeding profusely. From the larvæ from these streams only *A. punctipennis* were developed; from those taken in the pond 35 per cent *A. punctipennis* and 65 per cent *A. quadrimaculatus* were developed. It seems, then, that *A. quadrimaculatus* appeared in this pool later than *A. punctipennis*, just as on the Coosa. In certain houses examined 46 *A. quadrimaculatus* were found in three residences, no *A. punctipennis;* while in a vacant schoolhouse there were 6 *A. punctipennis* and 1 *A. quadrimaculatus.*

An examination by Griffitts of a few bayous near Cordova, October 13–15, showed the presence of *A. quadrimaculatus* in small proportion—about 7½ per cent—where none had been found earlier in the season. Only 58 imagos were developed, however, scarcely enough to base a percentage upon. There had been several frosts and it was cold, the water being 65° and 67° F. The September examination was not extensive enough to give data of much value in determining the amount of the production of the pool, nor was it intended for that purpose. The same is true of the visit to Cordova. It was too late to expect to find many *A. quadrimaculatus* larvæ.

MALARIAL FEVERS.

There was a considerable amount of malarial fever in the general neighborhood of this pool, from Cordova to the dam on the west side of the river. It is reported as having been particularly severe opposite the fork of the river on the west side, and is thought by the writers to have been equally prevalent in the Prescott Creek neighborhood on the opposite side of the river. We were informed that there had always been some malaria in this country, but only a moderate amount. No systematic investigation of this matter was made, but there seems no question but that malarial fevers were unusually prevalent in the section named last summer and fall. The same was true in a great many sections of the South—it was a bad malarial year everywhere.

Exactly how much of a factor this pool may have been in producing this condition in its neighborhood is not known. It is to be regretted that the biological examination of the pool and its environments was not sufficient to determine this point, although it throws some light on it. In the few residences examined in which cases of fever had occurred 50 *A. quadrimaculatus* and 2 *A. punctipennis* were found. The two *A. punctipennis* were found on October 15th in cold weather with four *A. quadrimaculatus* in the same room. Larvæ from a nearby breeding place developed 31 *A. punctipennis*, no *A. quadrimaculatus.*

ANOPHELES IN HOUSES.

As always, it was found in these surveys that, having regard to the production and proximity to sources of production, *A. quadrimaculatus* were found in residences in much greater numbers than *A. punctipennis*, while the difference was far less for sheds, pigpens, unoccupied houses, under houses, etc. To give the averages of the species found would be futile unless the distances from the source of production of each species and the extent of production were given.

In a section of one village, Talladega Springs, 10 houses apparently received their mosquitoes from (1) a small branch producing *A. punctipennis* profusely, but no *A. quadrimaculatus*, and (2) a concrete tank yielding about 5 per cent *A. quadrimaculatus*, 95 per cent *A. punctipennis*, and breeding profusely. There were other sources of *A. punctipennis* within a reasonable distance, but none of *A. quadrimaculatus* for four-fifths of a mile. Counting the production of the stream as equal to that of the tank—it was this, at least—the production of the two species close by should be 2½ per cent *A. quadrimaculatus* and 97½ per cent *A. punctipennis*, respectively.

The 10 premises gave:

Anopheles punctipennis:	
In residences	0
Under residences	3
Outbuildings	30
Anopheles quadrimaculatus:	
In residences	24
Under residences	21
Outbuildings	24

The residences then give, inside and under, a ratio of 1 to 15 (3 to 45). That of the production is 40 to 1. In other words, we found about residences 600 times as many *A. quadrimaculatus* as *A. punctipennis* in proportion to production, at *about* the same distance from the source of production.

The examination of 41 premises in the same village, including the above 10, having an occupied residence on each, gives:

Anopheles punctipennis:	
In residences	1
On porches	1
Under residences	19
Outbuildings	61
In walled spring	17
Anopheles quadrimaculatus:	
In residences	43
On porches	4
Under residences	31
Outbuildings	91
In walled spring	1

Numerical comparison is not possible here, as the houses undoubtedly received mosquitoes from a number of breeding places, some producing one species and some the other. They were, however, on the average decidedly closer to places producing *A. punctipennis* than to those producing *A. quadrimaculatus*, and the production of the first was many times greater than that of the second.[1] The houses next to the Sulphur Creek Bayou are not included in this list. They gave much greater numbers of *A. quadrimaculatus*.

Having regard to the production and proximity of source of production, the general fact that *A. quadrimaculatus* is much more often found in residences than *A. punctipennis* has been noted by our party for some time and, it is presumed, by others; but this is the first opportunity we have had for a comparison of this habit of the two species with even approximately definite numerical data. It is less extensive in number of houses (10) and less close in the approximation of the production than one could wish.[2] It should be observed how much oftener *A. punctipennis* were found in out houses than in residences. We have found this to be always true. In our experience *A. punctipennis* has been found only sparsely in residences in the daytime. Whether they do not enter at night, or enter at night and leave, is a question we hope to answer next year. On it depends whether they are a factor to be seriously reckoned with in the conveyance of malaria, and thus it is a matter of the greatest importance to the sanitarian.

AQUATIC VEGETATION—SURVEY OF POND AT BAY VIEW.

A survey was made of a small pond at Bay View near Birmingham, furnishing water for the Tennessee Coal & Iron Co. This pond the writers were informed, had not produced mosquitoes to an appreciable extent until the summer of 1915, and its environment had been free from malaria. It was several years old. There was no brush on its banks, and the banks had been cleaned with a hoe in the early summer. The company was anxious to have no malaria among its employees. This year, however, there was considerable malaria in the neighborhood of the pond.

We found a singular condition of affairs. The pond was skirted by an aquatic plant, *Naias flexibiles*,[3] which lay in the water like kelp only far finer and more flexible and as thick as it could well grow. It was close up to the shore and apparently[4] had finished its growth and was dying and decomposing. Dipping from the

[1] Note, too, the reversed proportion at the walled spring.

[2] Very few observations made early last spring and in October *may* tend to show that *A. punctipennis* is more often found in residences in cold weather than in summer, but the observations were too few to be worth recording here.

[3] Hitchcock, Bureau of Plant Industry.

[4] The survey was made on Sept. 22.

shore[1] was practically without result so far as Anopheles larvae were concerned, except in two small places where this grass was green. Here they were found in fair quantity. On examination from a boat we found the outside of this ring of grass—the edge next open water—generally alive and containing Anopheles larvae in abundance. Together with another kind (Culex species), *A. quadrimaculatus* and *A. punctipennis* were developed. There were fish in the pond, but not many.

Another pond of this company with much growth on its edges was examined two days later and was practically not producing.

The effect of dead and decaying green grass on production has been alluded to. In addition to the above instance, in two places on the Coosa pond a slight permanent rise of pond level covered flat fields of grass: One, Japanese clover (*Lespedeza*), and one, some other kind. The grass was about 6 inches high and the water from 18 inches to nothing. The places were about 5 miles apart. In the grass in both places were "bait holes" about a foot deep, where people had dug for angle worms, and in them there was no grass. These were from 18 inches to 3 or 4 feet across. They were of every shape. The grass was dead and decaying. The water had been up previous to the first visit 9 days for one place and 11 for the other; previous to the second visit 19 days. In the grass practically no Anopheles larvæ could be found, while in the bait holes they were abundant. From these bait holes many larvæ of *A. crucians* were obtained. Two instances of larvæ killed by leaving grass in the bucket with them until it began to decompose occurred. Grass was put in to prevent the larvae from drowning, as is done in carrying them in a boat.

Another plant (*Sparganium americanum*, or burr reed) was found in three ponds in Virginia in the fall. In one pond, the only one properly examined, Anopheles were breeding profusely. This was in October and the catch was practically all *A. punctipennis*. The study of aquatic growth, as implied in the first paper on that subject,[2] may be an important part of the investigation of impounded waters and their effect on malaria.

[1] Two men for two hours.

[2] Reprint No. 244, Public Health Reports.

SURVEY IN SOUTH CAROLINA.

The ponds examined in South Carolina were those of Parr Shoals and Stevens Creek. Their conditions will be noted only as they differ from those of the ponds already reported on. These ponds came to our notice in February, 1915, when, at the request of the health officer of South Carolina, a physical survey was made of them by Le Prince and Carter. The object of the surveys was to assist the health officer in determining what measures were feasible for the control of the production of malaria. Certain recommendations to this end were made to the health officer in both cases and copies furnished the power companies.

PHYSICAL CONDITIONS.

There were certain peculiarities common to both of these ponds. They were both constant level ponds, the contour of flowage being very close to the lowest allowable limit of the pond. This last was determined by the War Department, which required that the water should pass over the dam. In neither was wave action fully efficient. Stevens Creek was a long, very narrow pond with trees on the banks protecting it from winds and, where broad enough for wave action to be efficient, was extended in woods and brush. Only in the lower quarter was wave action efficient. The Parr pond was broad enough, but the existence of wooded islands—some submerged and some not—an old railroad embankment, and much large timber and smaller growth partly submerged, as well as wide expanses of shallow water, reduced the effect of wave action over much of its bank to a minimum. In some places it was good. Both contained many partially submerged woods and fields of saplings—pine and hard wood. These were dead or about to die, and as they died would rot and fall into the water, making drift and floatage. In both large collections of drift existed anchored away from the bank.[1] On one of them, in Stevens Creek, a man could walk about. Weeds were growing on them and in them mosquito larvæ might develop. In all these things they were alike—the conditions being intensified in Stevens Creek. In one thing they differed. Minnows were fairly abundant in the Parr pond, especially Gambusia, but were rare in Stevens Creek. Both were full of carp. Also such freshet rises as occurred made

[1] These are called "hammocks" in this county; also "floating islands."

more difference in the elevation of the pond of Stevens Creek than of the other, which also brought down a larger quantity of drift. Both ponds were closed in May or June of 1914, and both were surrounded by a fairly level rich farming country, thickly settled. That of Stevens Creek was the better country of the two. The rise of water in each case was 35 feet. The length of Stevens Creek pond is about 8 or 9 miles, that of Parr 12 to 15. The banks of the original streams came out of the water in the first about 5 miles from the dam, and in the second about 6½ miles from it, leaving rather large flats behind them covered with shallow water, especially at Parr.

The work recommended after the February survey for the pond at Parr contemplated cutting the brush from the banks from high-water line to as low a line as possible, raking the drift and floatage up from the water's edge; breaking up and setting adrift the hammocks and floating islands lodged in the woods; and some other minor work. An attempt to regulate the level of the pond so as to vary it from time to time and especially to keep it high in the winter was urged. The recommendations for Stevens Creek were somewhat different, but as they were not carried out, need not be mentioned. The recommendations at Parr were quite well carried out. The whole of the bank and edges were gone over, the brush was cut out, and the edges were raked. The side pools that needed it were ditched, giving fish access to them. A certain amount of this work was unnecessary, as it was done at places too far from residences to be needed and at places where breeding would not have occurred anyway, and the same amount of work would have been better applied if certain dangerous places needing it had been gone over more often or more thoroughly. On the whole, however, this work was well done and unquestionably lessened mosquito production. Occasion was taken during the biological survey to go with the man who had this work in charge and to show him just what was needed.

The surveys were made from July 17 to August 16. The physical surveys had been made in February, and the fact that we were familiar with the general lay of the problems saved some time on the biological survey.

SHELTER FOR LARVÆ AND BREEDING IN THE PONDS.

Leaf floatage was very little of a problem at Parr. Only in two creeks, Cannons and Hellers, was it sheltering larvæ of any sanitary importance. In another year it will be negligible. This is not so on Stevens Creek. On account of its narrowness, the trees on its banks, and its length, leaves will be abundant for years, and we found

enough larvæ on them to be of sanitary importance. As elsewhere, the fine floatage lodged with drift was the main shelter of larvæ. Algæ were a slight factor in their production at the time of the survey, and doubtless a greater factor later in the season.

This fine floatage consisted to a large extent of a small round granule,[1] apparently the excrement of small worms, mixed with detritus of wood. This material lodged against drift and, protected from wave action by drift or the contour of the bank, was the most frequent shelter of Anopheles larvæ in the pond. At times there would be only small patches of it, or a thin layer, and at times it would be an inch thick. When thick it was not always easy to see the larvæ, and many devices were used to do so. At times it would be compressed between pieces of drift and even forced up out of the water, sometimes 6 or 8 inches, high and dry. Then, of course, it would contain no larvæ. As in other ponds, larvæ were found most often and most abundantly in tortuous, steep-banked bights. The larvæ were protected from wave action by the shape of the shore, while such bights usually contained drift and floatage, and small fish avoided the deep water close to the banks. Coles and Mayers bights were of this nature, the latter at one time breeding profusely. Sometimes a bight, or even a part of a shore line, would be protected against wave action by heavy drift, and if there was even a small amount of floatage and the bank was steep so that minnows avoided it, larvæ were generally found. There was such a place north of the mouth of Cannons Creek.

Along the old railroad embankment a large number of larvæ were found on two occasions on the west side, but practically none was found on the east. This fact was doubtless due to a southeast wind that usually prevailed. After a heavy squall from the southwest none was found on the west side. This shore was steep and had grass hanging over in the water with a moderate amount of floatage against it.

The banks of the river were much higher than the flat lands just back of them, with the result that from where the banks first showed out of water for 2½ to 3 miles higher up there were large shallow collections of water running behind the banks, in some places crossed by ridges of land and in others opening into the river through creeks and branches. Strange to say, we found no breeding of sanitary importance in these places. Occasionally, a number of larvæ would be found in bulrushes or about the mouths of creeks where drift and floatage had collected, but we did not find these wide sloughs producing. They were alive with minnows. Nor did we find much breeding in the bayous of creeks.[2]

[1] It was best seen with a hand lens.

[2] We dipped both from the banks and from canoes.

On the south side of the bayou of Cannons Creek, beginning about a mile and a half from its mouth, there was a field covered with partly submerged saplings, dying and casting their leaves. In this field, from the beginning to about half a mile higher up the creek, this leaf floatage sheltered many larvæ. Larvæ were found all along this creek, from above this place to live water. In the live water and in sloughs, small marshes, and "potholes" adjacent to it, Anopheles were breeding profusely. Many evidently were washing down the creek, but the lower groups were of all ages and too far from live water to have been washed down. They were evidently from eggs deposited about where we found them.

Practically nothing was found on the banks of the bayou of this creek;[1] nor was anything found in its lower reaches (1¼ to 1½ miles from the river). Two visits were paid to this place, July 28–29 and August 13, and while the breeding was not quite the same the second time, the absence of breeding was the same.

Although many creeks were examined, practically no creek bayou except Hellers was found breeding. A small number was found half way up Terrible Creek, and there were enough to be of sanitary importance in a limited area against a steep bank on Coles Creek bayou, but generally the above statement was true.

Hellers Creek bayou covers as much area as some ponds, though less than Cannons. It is continuous on the north with a long extension of shoal water, running about 2 miles up the river behind the bank. This slough was free from larvæ, except in a rather extensive fringe of bulrushes next to the river. It was alive with minnows. The bayou, however, was producing mosquitoes sparsely or moderately for a space of about half a mile on the south side, in fine floatage and drift, and to a lesser extent in leaf floatage lodged against tree logs, etc., or just adrift. The shallow bank, fairly clean, was not breeding them, or breeding so little as to be of no sanitary importance. It was lined with minnows, many of which were Gambusia. The breeding of mosquitoes covered two areas: The first about 300 yards long and, after a space which was barren, one of about 200 more. The total production, therefore, was large. This was in flooded woods.

SILVER-LEAF GRASS.

In the upper part of Hellers Creek bayou and in the part to the north of the creek we found very few larvæ; but in a bight above the bridge which crosses the creek we found a mass of water grass in which mosquito larvæ were breeding profusely. They were of three kinds, including Anopheles *quadrimaculatus*. This plant covered a large area (one-half acre or more). It grew with its leaves flat

[1] Those spoken of above were away from the bank—300 to 400 yards or more.

the water and looked like a bright green lawn. It was growing in from 4 to 8 feet of water; but the water was not visible. Fish were around the edge and some in the mass of leaves, but not many, for they evidently could not penetrate the growth. The breeding of Anopheles would be called only moderate, but that of others was very profuse. Anopheles were most abundant where the leaves were not very thick. The others were everywhere. The Anopheles developed were *A. quadrimaculatus*. Owing to an accident all the pupæ captured, except the Anopheles, died. Later Dr. Howard reported specimens sent him as *Uranotaenia Sapphirinas* and *Culex* of undetermined species.[1] Since this pond was only 14 months old, evidently this grass is of very rapid growth. I have seen it in one other pond, a lake at Columbus, Ga., where it covered the whole surface of the lake—some 6 to 8 acres. It is then capable of doing an immense amount of harm in increasing the propagation of mosquitoes. Two tufts were seen lower down in the same pond and one had been seen near Dawkins—some 3 miles above on the other side of the river. This plant was identified by Dr. Hitchcock, of the Bureau of Plant Industry, as *Hydrochloa carolinensis*. It is known locally as Silver Leaf, but is rare. Only one person in the neighborhood was encountered who had ever seen it. He said that it had destroyed a fishpond. It encourages profuse breeding of mosquitoes. We had this patch raked out and the other three as well, with directions to visit the place once every two weeks and rake out everything that appeared. The three small ones could be destroyed by one operation—the large one could not. This is given in detail, because (1) it is the first time a particular aquatic growth has been a serious problem and (2) this was an exceedingly serious one, and if this grass were to spread as it had begun, an insoluble one. In some older ponds, as we shall see, aquatic vegetation may be quite a problem, but we have seen none so bad as this.

HAMMOCKS IN PONDS.

We found nothing of sanitary importance between the bights above the mouth of Cannon's Creek and the dam. To our surprise we found no breeding of sanitary importance even at Parr Shoals on hammocks and floating islands. True, they had been set adrift before our arrival, but a number of them had not gone far, or others had formed. Some of them were breeding moderately, but nine out of ten were barren. At Stevens Creek we found very scanty production, generally none on the larger hammocks. Where new floatage had lodged against them, it contained larvæ—sometimes

[1] For the identification of this last it was necessary to have the larvæ, and as we had gone to Alabama before we received his letter we were unable to furnish them.

in abundance. Reaching Stevens Creek during a freshet, we found much drift of floatage, which was not the case in the main body at Parr Shoals Pond, where these hammocks were found. The larvæ on a hammock were frequently of different sizes and were sometimes in places to which they could not have drifted, i. e., inside of the hammock, and were, it appeared, from eggs deposited there. It is worth noting that minnows were very common around these hammocks. We found larvæ in them occasionally in water probably 20 to 25 feet deep.

MOVEMENT OF LARVÆ ON THE PONDS.

The freshet at Stevens Creek put in motion a great deal of drift and floatage, which went down stream, and then when the Savannah River, into which the creek empties, rose the floatage stopped and then drifted with the winds. At first the fine stuff and small trash was much scattered, but it was collected together within a few days, and in a few more went to the banks or occasionally lodged against obstructions in the stream. This floatage carried Anopheles larvæ in large numbers. They drifted about across the pond and up and down. At first these were of all sizes, but practically no pupæ; by the end of a week the very small ones had disappeared, the larvæ were nearly all full size and pupæ were present, the latter being more generally found in a resting place than adrift. Full-grown larvæ do not merely drift about on floating objects; they possess considerable power of selection as to where they will go in open water. Griffitts put a full-grown Anopheles larva in the water in Hellers Creek Bayou and followed in a canoe some yards off. It went to a piece of bark. This he submerged slowly, and the larva went off in a fairly straight line for, say, 20 feet and attached itself to a leaf. It left this voluntarily and went about 15 feet at an angle to its former course to another leaf. This was sunk, and so several times. The larva went within 20 minutes at least 90 feet from its starting point over a course of approximately 120 feet. Frequently we would sink a dipper of floatage containing larvæ down under the water to get the larvæ separate. They would swim off—for some feet or yards even—and attach themselves to some object floating on the water. Sometimes they showed distinct preference, passing by bits of drift to attach themselves to other pieces or letting go one piece to select another. They are by no means, then, entirely dependent on the drift of the object to which they are attached for change of place. When there is any motion on the water, however, we have never seen them leave the object to which they were attached unless frightened.

Over a considerable part of Stevens Creek Pond the breeding was profuse—the heaviest general production we have ever seen in a large

pond. Strange to say, the breeding was sparse, absent for long stretches, at both the upper and lower ends. Possibly the freshet coincident with the beginning of our visit washed out or stranded all the floatage from the upper part of the pond, and with the floatage went the attendant larvæ.

Minnows were scarce in this pond, and yet a shallow place in an old cotton field which showed free breeding one day showed none two days afterwards, and the spaces between the rows had many minnows. This is the only shallow place in any pond where we have ever seen very free breeding. There was some protection from dead grass, but larvæ were quite abundant where there was no protection.

Willows were abundant in the Parr Shoals Pond, and when partially submerged they sent out a mass of fine roots just at or above the water level. These should be ideal shelters for larvæ, but larvæ were very rarely found among them, even when they contained floatage. The same plant with the bunch of white, fibrous, aerial roots hanging down in the water mentioned above occurring in the Coosa Pond was very abundant here, and, as at the Coosa, larvæ were never found among its roots.

This observation at Parr Shoals seems worthy of record, only we have no explanation of it to make. On the evening of August 12 there was a rise of 10 to 12 inches in the lower part of the pond. Much drift came down. There was a steady moderate wind directly up the river, slightly toward the right bank. This had little effect on the heavy stuff, which was deep in the water, but held back the lighter. In the afternoon of August 13 fine drift could be seen in some places like a film on the water. There was little current then—almost none except in midstream. On the 14th there was found a body of very fine floatage, 75 by 150 feet, above the mouth of Cannons Creek in very still water. In this there was a very large number of "baby" larvæ—none over 2 or 2½ days old, most of them just hatched. Whether this patch of floatage was the film seen the day before concentrated, or whether it drifted in already formed, is a question. The larvæ were all of approximately one age and all very young. The floatage itself was out in deep water over the old river bed—about 30 feet deep—but not in midstream. If the floatage had been simply released by the rise of the river from where it was resting with the larvæ already in it, one would have expected them to have been of different ages, as at Stevens Creek. The fact that they were all of one age implies that they were from eggs laid about the same time and very recently when this film of floatage was adrift, i. e., eggs were laid out in the stream. As we left the next morning, the progress of this lot could not be followed. The floatage would naturally, most of it, go to the bank.

SPECIES OF ANOPHELES—PREFERENTIAL BREEDING PLACES.

From larvæ secured in the pond *A. quadrimaculatus* predominated—349 *A. quadrimaculatus* to 42 *A. punctipennis* is the record for the first visit to Parr Shoals. Stevens Creek gave about the same proportion, *A. punctipennis* being rather more numerous. A large amount of breeding was found in running streams and in marshes and pools adjacent to them, but these were not searched as widely as we did later at the Coosa Pool. The record from running streams and from marshes and pools adjacent to them is: *A. quadrimaculatus*, 2; *A. punctipennis*, 280. It is probable enough that these two *A. quadrimaculatus* were accidental contaminations. At Stevens Creek the branches had just been washed out and were not examined. The few developing from this catch—eight only—were *A. punctipennis*. No *A. crucians* were seen at either of these two places, although they were abundant around Hartsville, a town about 40 miles distant.

A thing that impressed us here was that *A. quadrimaculatus* not only was found in the pond but larvæ of this species was not found in the neighborhood of the pond in places where one would naturally expect to find them. It was a fairly flat country and showed a number of small marshes, of little pools of clear water in grass, ditches, potholes, etc., in which one expects to find this species and in which we did find them at Eau Clair, about 20 miles distant. The same thing occurred at the examination of the Coosa pool. Although there were no check examinations there in which we found *A. quadrimaculatus* as at Eau Clair, yet finding this species in considerable number in houses at Shelby—5 or 6 miles from the pond—and in other houses in the country $1\frac{3}{4}$ to $2\frac{1}{2}$ miles distant indicates that they do breed in this section.

Though not extensive, the examination of Pool 17 on the Black Warrior, so far as it went, evidenced the same thing. It looks as if the pond were a *preferential breeding place* for *A. quadrimaculatus*, so that *when a pond is available this species may breed nowhere else;* that places which produced this form before the pond was made do so no longer. If this be true, to determine the influence of the pond on the production in any district of *A. quadrimaculatus*, we must deduct from the production of the pond the number formerly produced by former breeding places *outside* of the pond and now no longer producing, as well as those covered by the pond.

While this hypothesis will explain the facts observed, and hence is an allowable deduction from them, it is not a necessary one. To determine this question, it is proposed that the sites to be occupied by a large pond and its environment be surveyed before the pond is made as well as afterwards. If the site selected be in a district in

which *A. quadrimaculatus* is breeding pretty generally this question can be determined. If after the pond is filled—say, the second year—the differential breeding habits of these two species as to locality are the same as observed at this place and at the Coosa pool, it will be decided in the affirmative. Examination of the surrounding country beyond the possible influence of the pond, to determine the production of *A. quadrimaculatus* therein, should also throw light on the subject. The observations at Eau Clair, not made for this purpose, and at Shelby are on this line. Possibly the presence of the small number (only two) of *A. quadrimaculatus* in the drift in Cedar Creek on the Coosa River may mean that they were from side pools or small marshes very far from the pond and were washed down on floatage. This creek was very large and long and with bold banks, and this could happen.

It is well known how *Aedes calopus* accommodates herself to available breeding places. Remove artificial containers, gutters, etc., and she takes the axils of leaves and other out-of-the-way places. Put out a few buckets of water—"trap breeding places"—and the eggs will be deposited in them to the exclusion of the out-of-the-way and presumably less eligible places. It is then in accordance with analogy that *A. quadrimaculatus* might also show a similar adaptibility.[1]

ANOPHELES IN HOUSES.

The same facts were observed as to the greater frequency of *A. quadrimaculatus* in residences as compared with *A. punctipennis*, as have been given for the Alabama survey, but no attempt was made, as was done there, to get quantitative data.[2]

DISTANCE OF FLIGHT OF A. QUADRIMACULATUS.

Some observations on the distance of flight[3] of *A. quadrimaculatus* were made during this survey. They are not sufficient as yet to publish, but will be used subsequently. Obviously, the breeding conditions which we believe we found existing in the neighborhood of these ponds are ideal for the determination of the distance of flight of this species of Anopheles. If this species breeds only in the pond and

[1] In this connection see "The Mosquitoes of North and Central America and the West Indies," Howard, Dyar, and Knab, p. 221.

[2] We note that at Mr. Cheatham's—about one-half of a mile from the Stevens Creek pond and 100 yards from a stream breeding *A. punctipennis*—68 *A. quadrimaculatus* were counted in one bedroom, and "thorough search not made." No *A. punctipennis* noted. In the same room later "30 *A. quadrimaculatus* taken from wall, larger number on ceiling." No *A. punctipennis* noted. At Mr. Mayers's—about one-fourth mile from the Parr Shoals pond, a bight breeding profusely at the time—"many *A. quadrimaculatus* taken under the house." The house is screened. "No *A. punctipennis* seen at the house," yet there was a place producing the latter species profusely closer than the pond. This comparative scarcity of *A. punctipennis* in residences was, during the summer, observed whenever examination was made.

[3] Ultimate, or maximum, distance of flight is meant.

avoids other suitable places in the vicinity—as we think—it is unnecessary to make the very careful search for local breeding places in the neighborhood of the pond and residence in which *A. quadrimaculatus* is found which is otherwise required, especially if they are found in numbers, as at Cheatham's. One can well imagine that the flight to obtain the first meal of blood required for oviposition may be farther than subsequent ones, which are the only flights which can convey malaria—the impulse to continue the species being greater in most insects than the desire for any special kind of food.

The great flight observed by Le Prince at Gatun was associated with no increase of malaria. The mosquitoes, *A. tarsimaculata*, came a great distance from their breeding place to the nearest sufficient blood supply—the village of Gatun—and fed. They apparently returned to their breeding places—the closest to the blood supply available—to deposit their eggs and did not return. Unquestionably they were not in any considerable numbers in these villages after they became infective to men—about 11 days after feeding for this form in Panama—else there would have been an increase in the malarial rate, which did not vary from three-fourths per cent during this flight and for many weeks afterwards. The flight at Miraflores showed the same picture.

The data we have lead us to believe that the maximum flight of this species (*A. quadrimaculatus*) is farther than has been usually supposed; at least, if the production is very great and no sufficient blood supply is close. In the matter of flight the different species of Anopheles should be considered separately. As they differ in so many characteristics, it would be an unwarrantable assumption that there was for the different species no difference in this. This question—the distance of ultimate flight—not only directly concerns our present problem—the effect of impounded waters on the incidence of malaria—but is very important in all antimosquito measures against malaria.

RECOMMENDATIONS.

Recommendations in detail were made in writing and verbally to the managers of both ponds for their better sanitation as regards malaria. Some of these were being put in force for the pond at Parr before we left.

RELATED PUBLICATIONS.

AVAILABLE REPRINTS OR BULLETINS ON MALARIA ISSUED BY THE PUBLIC HEALTH SERVICE, FROM WHICH COPIES MAY BE OBTAINED WITHOUT COST.

REPRINTS FROM THE PUBLIC HEALTH REPORTS.

28. Prevention and Destruction of Mosquitoes. By Joseph Goldberger. July 17, 1908.
105. Antimalarial Measures for Farmhouses and Plantations. By H. R. Carter. December 6, 1912.
108. Malarial Fevers—Prevalence and Geographic Distribution in Alabama. By R. H. von Ezdorf. December 27, 1912.
156. Malaria in North Carolina. By H. R. Carter. December 19, 1913.
159. Malarial Index Work. Methods used in Obtaining Blood, making Blood Smears and Staining. By R. H. von Ezdorf. December 26, 1913.
160. Malarial Fevers. Prevalence and Geographic Distribution in Arkansas. By R. H. von Ezdorf. January 2, 1914.
170. Prevention of Malaria. Suggestions on How to Screen the Home to Keep out Effectively the Mosquitoes which spread the disease. By R. H. von Ezdorf. February 27, 1914.
172. Malarial fevers. Prevalence and Geographic Distribution in South Carolina, Georgia, and Florida. By R. H. von Ezdorf. March 13, 1914.
175. Quinine Prophylaxis for Malaria. By H. R. Carter. March 27, 1914.
180. Malarial Fevers in the United States. By R. H. von Ezdorf. April 10, 1914.
186. Malarial Fevers. Prevalence and Geographic Distribution in Alabama. By R. H. von Ezdorf. May 1, 1914.
193. Malarial Fevers. Prevalence and Geographic Distribution in Mississippi, 1913. By R. H. von Ezdorf. May 22, 1914.
217. Mosquitoes and Malaria. Report on a Short Trip in Eastern North Carolina. By Ch. Wardell Stiles. September 4, 1914.
244. Impounded Water: Some General Considerations on its Effect on the Prevalence of Malaria. By H. R. Carter. December 25, 1914.
248. Impounded Waters: Their effect on the prevalence of Malaria—Survey at Blewetts Falls. By H. R. Carter. January 1, 1915.
257. Impounded Waters. A Study of Such Waters on the Coosa River in Shelby, Chilton, Talladega, and Coosa Counties, Ala., to Determine the Extent to which They Affect the Production of Anophelines, and of the Particular Conditions which Increase or Decrease their Propagation. By J. A. A. Le Prince. February 12, 1915.
258. Malaria Control. Drainage as an Antimalarial Measure. By J. A. A. Le Prince. February 19, 1915.
260. Control of Malaria. Oiling as an Antimosquito Measure. By J. A. A. Le Prince. February 26, 1915.
272. Anopheline Surveys. Methods of Conduct and Relation to Antimalarial Work. By R. H. von Ezdorf. April 30, 1915.
277. Malaria in the United States. Its Prevalence and Geographic Distribution. By R. H. von Ezdorf. May 28, 1915.
290. Anopheles as a Winter Carrier of Plasamodium. The Mosquito as a Prophylactic Indicator. By M. Bruin Mitzmain. July 16, 1915.

SUPPLEMENTS TO THE PUBLIC HEALTH REPORTS.

11. What the Farmer Can Do to Prevent Malaria. By R. H. von Ezdorf. February 13, 1914.
18. Malaria—Lessons on its Cause and Prevention. (For use in Schools.) By H. R. Carter. July 17, 1914.

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TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 80
OCTOBER, 1916

TRANSACTIONS OF A SPECIAL CONFERENCE OF STATE AND TERRITORIAL HEALTH OFFICERS WITH THE UNITED STATES PUBLIC HEALTH SERVICE

HELD AT SALT LAKE CITY, UTAH
FEBRUARY 2-3, 1916

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

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LETTER CALLING THE CONFERENCE.

The following letter was addressed to the health authorities of the States and Territories and the District of Columbia:

TREASURY DEPARTMENT,
BUREAU OF THE PUBLIC HEALTH SERVICE,
Washington, January 6, 1916.

SIR: In accordance with requests received from seven Rocky Mountain States, and under authority of section 7 of the act of Congress approved July 1, 1902, a conference for the purpose of considering rabies, Rocky Mountain spotted fever, and other public-health matters will be held in Salt Lake City, Utah, at 10 a. m., February 2, 1916. In addition to the States which have joined in the request for a conference, an invitation is extended to every State and Territory desiring to be represented to send one delegate each. I will be pleased to be informed of the name of the delegate selected to represent your State.

Respectfully,

RUPERT BLUE,
Surgeon General.

SPECIAL CONFERENCE OF STATE AND TERRITORIAL HEALTH OFFICERS WITH THE UNITED STATES PUBLIC HEALTH SERVICE.

TRANSACTIONS.

SESSION OF FEBRUARY 2, 1916.

MORNING.

A special conference of the State and Territorial health officers with the United States Public Health Service was called to order at 10 o'clock on the morning of February 2, 1916, in the State Capitol Building, Salt Lake City, Utah. Asst. Surg. Gen. J. W. Kerr presided as chairman, and Surg. L. D. Fricks acted as secretary.

The following official and other delegates and guests were present:

State delegates:

California—Dr. E. F. Gundrum.
District of Columbia—Dr. W. C. Woodward.
Idaho—Dr. E. E. Laubaugh.
Kansas—Dr. J. J. Sippy.
Montana—Dr. W. J. Butler.
Nevada—Dr. S. L. Lee.
Oregon—Dr. David N. Roberg.
Utah—Dr. T. B. Beatty, Dr. F. S. Bascom, Dr. A. F. Doremus, Dr. H. K. Merrill, Dr. Fred Stauffer.
Washington—Dr. T. D. Tuttle.
Wyoming—Dr. W. A. Wyman.

Representatives of Public Health Service:

Asst. Surg. Gen. J. W. Kerr.
Surg. L. D. Fricks.

Guests:

Gov. William Spry of Utah.
Agricultural Department—
Biological Survey—Dr. A. K. Fisher, E. F. Averill, R. E. Bateman, L. B. Crawford, L. J. Goldman, S. F. Piper, E. R. Sans.
Bureau of Animal Industry—Dr. F. E. Murray, Dr. H. J. Hammond.
Bureau of Forestry—C. Du Bois, George E. Holman, L. F. Kneipp.
Solicitor's Office—J. F. Lawson.

Guests—Continued.

Railroads—

Dr. T. R. Crowder, Pullman Co.

Mr. R. E. Elliott, "Salt Lake Route."

National Woolgrowers' Association—

Thomas Austin, W. N. McGill, James H. Moyle, George Russell, jr., C. L. Stewart.

Other guests—

A. A. Callister, secretary Utah State Board of Sheep Commissioners.

C. F. Emory.

Dr. George W. Clark, Springville, Utah.

F. C. Cooley, Salt Lake City health department.

J. J. Craner, Salt Lake City water commissioner.

Dr. C. G. Gowans, Utah State superintendent of public instruction.

A. E. Kimball, Elko, Nev.

Hardie Lynch, bacteriologist, Salt Lake City.

H. J. Pack, Salt Lake City.

Dr. S. G. Paul, city health commissioner, Salt Lake City.

W. J. Seely, Salt Lake City.

B. A. Vance, Fairview, Utah.

Dr. A. C. Young, Utah State inspector of live stock.

Mr. Delaney.

The CHAIRMAN (Dr. J. W. KERR). Gentlemen and delegates, under a Federal act of July 1, 1902, the Surgeon General of the Public Health Service is required to call annual conferences of State and Territorial health authorities with the Public Health Service to consider public health matters. Moreover, on request of a minimum of five States he must call special conferences. This conference belongs in the latter category, and is called in response to requests from the States of California, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

In calling the conference to order I have to express to you the regret of the Surgeon General at not being able to be personally present. I also wish to express appreciation of the beautiful place in which we have to meet and the privilege of coming to this Western State, which has taken such an active part in public health matters.

We are fortunate this morning in having present his excellency the governor of Utah, and I shall ask Dr. Beatty, the secretary of the State Board of Health of Utah, to make a few remarks introducing the governor.

Dr. T. B. BEATTY. Mr. Chairman and members of the conference I am sure that our governor needs no word of introduction. You all know him by his acts. I can say that, with reference to the welfare

of the State as pertains to public health, we have his hearty support, as we have always had in all lines in which the welfare of the State is concerned. In this special question of rabies he was one of those who took the initiative, appointing a commission to consider ways and means of preventing an outbreak in this State. So far as Utah is concerned, rabies has not yet been known to appear; but Gov. Spry has appreciated, as others of us have, the need of taking steps to prevent its appearance. I am sure he will welcome you, the delegates to this conference, and open our doors wide to you.

Gov. SPRY (of Utah). Mr. Chairman and gentlemen, I am sure it is a very great pleasure, particularly to our people here in Utah, to have so many gentlemen assembled together for the purpose of discussing so vital a question. It is not more than a month or so since Dr. Beatty, Dr. Young, and other Utah officials were privileged to meet with Federal representatives to discuss the advisability of taking immediate steps looking toward the eradication of rabies, which has done so much serious damage in other States and is likely to come into this State. On the principle that an ounce of prevention is better than a pound of cure, it was thought proper to make requests for a convention of this character so that a united effort could be made, and men distributed over various parts of the West would be able to take this matter properly in hand and, through organization, accomplish, perhaps, a complete eradication. I appreciate that this will not be done at once. To a small extent I am conversant with the western range and the habitat of the coyote, and I can appreciate how difficult the task you are now about to undertake. I was very glad to wire our Senators in Washington and ask if some emergency appropriation could not be made for use in the departments which will have this matter in hand, and I was very glad to know that Senator Smoot succeeded in getting an emergency appropriation of $75,000. I appreciate that still greater appropriations will have to be made, and that it will take a long time to make this work effective.

I am very glad to see so many representatives of the various departments of State and Federal Governments combining together upon this matter, because I heartily believe that it will only be accomplished through the most complete organization; and speaking for this State, Mr. Chairman and gentlemen, I want to say that we are anxious to be of service wherever we can, not merely in the governor's office, but in the various State departments, in our board of health, in our live-stock department, through our board of sheep commissioners, or in whatever department can be utilized in this work.

I repeat, I am glad you are here; I am glad that we are able to furnish so convenient quarters, as the chairman has suggested. I wish you all kinds of success in your deliberations and sincerely trust that

you may come to conclusions which will enable us all, all of these Western States, to move forward as one solid body, having in view the eradication of this serious thing which threatens us all at this time. I thank you.

The CHAIRMAN. I feel that I speak for the entire conference in again expressing our appreciation of the presence of the governor and his wishes for a successful conference.

Under the law each State board or department of health is entitled to one delegate; but in accordance with precedent we extend an invitation to all members of the State boards to be present and take part in the deliberations. We are also pleased to welcome other officials and representatives of commercial organizations as guests, and we shall be glad to have them participate in the discussions. These conferences are in their nature informal, with the idea that we will all get together and that our discussions will result in the passage of resolutions or motions which will be morally more or less binding on us and which we will take to our respective jurisdictions and endeavor to put into force.

In order to save time and facilitate business, I would like to ask the indulgence of the conference to appoint a committee on resolutions. It is purposed that the report of this committee will be practically the last act of the conference. On the committee I would like to appoint Dr. Woodward, of the District of Columbia; Dr. Beatty, of the State Board of Health of Utah; Dr. Tuttle, commissioner of health of the State of Washington; Dr. Gundrum, of the State Board of Health of California; and Dr. Fricks, of the Public Health Service.

It may be desirable to appoint additional committees to consider and harmonize the views of those present in respect to the questions discussed, and I will take the liberty of appointing such committees from time to time as may seem necessary.

RABIES.

The first topic of the provisional program, and the one that is mainly responsible for our being present this morning, is rabies. It is a very large and complex problem, because it is an economic as well as a public-health matter and because it differs materially in different parts of the country. The attention of the Federal Government has been brought to the subject in very recent years on account of outbreaks in New England and the North Atlantic States. In 1909, in collaboration with Surg. A. M. Stimson, of the Public Health Service, I secured a census of the prevalence of rabies in human beings and of a number of foci of the disease among animals. At that time it was found that the disease extended through three

quarters of the United States, but that there were no cases in the Rocky Mountains and Pacific Coast States, with the exception of one focus and one death from the disease in Arizona. The focus among the animals was reported as being among skunks. No reports of cases or of the presence of the disease among other wild animals were received by us. In 1911 another census was made, and it was found that the disease had extended practically to all the country, and that outbreaks were reported in California and other States. I doubt if in very recent times the disease has been more prevalent in the Western than in the Eastern States. It has been quite prevalent, as Dr. Woodward will agree, in and around the District of Columbia. For that reason we established a Pasteur institute in the Hygienic Laboratory and have since furnished antirabic virus to State health authorities for the treatment of persons bitten by rabid animals. Many Pasteur institutes have sprung up since that time among the State boards of health and have greatly relieved us of the increase in this work.

The problem in the West, as I understand it, is complicated by the presence of wild animals, particularly coyotes. I think we are fortunate this morning in having present, not only representatives of the State boards of health and of the Public Health Service, but representatives of the three bureaus of the Department of Agriculture which are interested in the subject, and also representatives of the National Wool Growers' Association. I propose, without further remark, therefore, to call on the delegate from each State, in alphabetical order, to give a statement of the prevalence of the disease in his jurisdiction, the authority he may have for combating it, and the steps that are being taken under that authority. After we hear from the representatives of the State boards of health I shall call on others present.

Dr. GUNDRUM (of California). The first time that rabies began to be so prevalent in California that we frequently received heads to examine at the State board of health laboratory was in November, 1909. In 1910 the disease became more common, but was practically limited to the vicinity of Los Angeles and the extreme south. The epidemic gradually spread up the State until we received positive brains from dogs in Siskiyou County about 1914. So far as coyotes are concerned, positive results were obtained in 1913 in parts of Tulare County, in the valley about 150 or 200 miles south of San Francisco. We received no other coyote heads until February, 1915, when two came from Modoc County, which were negative, and one from Lassen County, also negative. In October, 1915, we received eight or nine heads from Modoc and Del Norte Counties, in the extreme northwestern corner of California. They were all positive except one.

Examinations made at the State laboratory from the 1st of November, 1909, to the 1st of April, 1911, numbered 406. At that time the branch laboratories, the Los Angeles city laboratory, the San Francisco city laboratory, and the laboratory at the Government post at Presidio also began making examinations; and in the year from the 1st of April, 1911, to the 1st of April, 1912, about 300 examinations were made. Two hundred and fifty-five were positive. From 1912 to 1913, 600 examinations were made, 548 positives; from 1913 to 1914, 609 positives; from 1914 to 1916, the last two years, only 156 positives. The total number of positive animal brains was therefore about 1,815.

Until May, 1912, we undertook the entire treatment of rabies in California through the courtesy of the Hygienic Laboratory of the Public Health Service; but we began to get such a large number of cases that we found it advisable to make antirabic virus of our own in our laboratory at Berkeley. From May, 1912, to date we have given through State laboratories 650 treatments, with a mortality of three, a little less than one-half of 1 per cent. There have been given, as nearly as we can find out, another 650 treatments from virus obtained from commercial sources. We do not know the results obtained in those cases.

We began the manufacture of virus with an emergency fund which we transferred from one fund to another in the State board of health. The legislature in 1913, however, provided us with a fund for the control of rabies, and they also provided us with two laws (chapters 369 and 391 of 1913). One provides for the establishment of a laboratory for the manufacture of antirabic virus; the other provides a quarantine law, under which the State board of health has the right to declare any area quarantined for rabies against any animal that it names. It devolves upon the State board of health to find out where there is sufficient reason for maintaining a quarantine, and it devolves upon the peace and health officers of that community to see that all animals quarantined against are either under leash on the owners' premises, or in a paddock from which they can not escape, and that all those found at large are shot at once. This law provides also for the levying through the supervisors of a special license tax which will repay, to a large extent, the expenses of the campaign against rabies. That law we have had occasion to use several times, and it has proven very workable.

The question was not so largely financial until this year. At first outbreaks of rabies occurred in small or large towns and agricultural neighborhoods, usually where the most dogs were congregated. It was not until about four months ago that rabies reached the cattle-raising country; that is, the northeastern corner of the State. There the disease developed among coyotes, which are very prevalent in that

neighborhood, as the country is not thickly settled. The disease speedily proved very troublesome, and people in the country districts could not send their children to school. It produced a reign of terror in the small communities. I think the loss from October, 1915, to the first of this year was about $20,000.

The supervisors of Modoc County, on the 1st of November, asked that we quarantine that county, and we did so. We quarantined Lassen County on the 29th of November. So far we think we have done well in such portions of these counties as we have been able to get into. Unfortunately the snow has made it extremely difficult to work in all parts of the districts at once.

The total mortality among human being from rabies in California is 34. For 1915 it was 5; for 1914, 3; for 1913, 8; for 1912, 7; for 1911, 3; for 1910, 4; and for 1909, 4.

Dr. W. C. WOODWARD (health officer, District of Columbia). Mr. Chairman, I am not prepared to furnish any figures with respect to the question of rabies in the District of Columbia. Our problem is very different from the one that is presented here by the representatives of these various, vast Western States. The District of Columbia comprises only 60 square miles, and as it has a population of approximately 355,000 the rabies work is largely municipal.

Rabies has been with us for a number of years, particularly among dogs, with an occasional case occurring among cats and now and then a case in a horse or a cow. Since 1878 all dogs in the District of Columbia have been required to be licensed, and a dog with a license on his collar is permitted to run at large. Under the law, however, the Commissioners of the District are authorized, in the event of the prevalence of rabies, to issue a proclamation for a stated period requiring the muzzling of dogs. It is my recollection that that right was first used about 12 years ago, when a few cases of rabies among dogs and one death of a human being occurred. We had the experience that the States have had—the bitter opposition of the owners of dogs. After that year there was an interval of two or three years before it became necessary to issue a similar proclamation. I think there was no doubt but that rabies was present in the District during that interval, but we did not have evidence on which to base a proclamation. Since the second proclamation was issued, about six or eight years ago, a proclamation covering one year has been issued annually. A dog that is not tagged and a dog that is not muzzled, whether tagged or not, can be taken up by our poundmen. Unless redeemed by the owner in 48 hours it is killed. In addition to the dogs so killed there are many on which taxes are not paid and which are surrendered by the owners, so that we kill an average of about 4,000 dogs every year. We also forbid animals from trespassing or going at large.

We have no license for cats, but we undertake to trap them on receipt of a complaint from anyone of a cat nuisance. About 4,500 cats are caught in this way or surrendered by the owners each year. The destruction of these animals, however, has not made a real impression on the general canine and feline populace. I think we have identified probably from 8 to 15 rabid animals a year. Last year we had two deaths of human beings from rabies.

The weak point in our system lies, in the first place, in the failure of citizens to cooperate in the muzzling of dogs; in the second place, in our failure to enforce the muzzling order because of two weaknesses in it. The law specifies that a dog shall be effectually muzzled; but it is difficult to determine what an effectual muzzle is, and we have no serious support from the courts. Unless we can make it pretty clear that a muzzle was ineffectual we lose our case. Possibly the weakest point in the law is that it permits a dog to run at large at night. There is nothing to indicate to the poundmen whether such a dog is muzzled or not. Certainly any dog law, to be effectual, should absolutely keep all dogs off the street between sunset and sunrise.

Dr. E. E. LAUBAUGH (State bacteriologist, Idaho). Gentlemen, Idaho is deeply interested in this problem. She is interested in it because she has to be. The epidemic is rapidly spreading across Idaho, starting from the Oregon line.

In 1911 in the northern part of the State—the panhandle—two cases were reported which we have every reason to believe were rabies. From 1911 until August, 1914, the board of health has no reports of the disease. But on August 19, 1914, a man at Boise was attacked by a dog with rabies. We immediately wired to California, saying the man was coming for treatment, but California replied: "We are sorry. We can't give you treatment, for you are not a citizen of California." The result was that we took up the problem with the Public Health Service, and they very kindly consented to furnish us antirabic virus.

During 1914 we had nine heads of domestic animals, four positive; but in 1915, 76 heads were sent to the laboratory, with 40 positives, or a tenfold increase. Already in 1916 we have had 16 heads, with 13 positives. Utah should be extremely interested to know that Cassia County was not involved until two weeks ago, when we received a coyote head from it that was positive.

Now, what are we doing to control this epidemic? Gentlemen, we are doing the best we can without money. We have a very good working law which gives the State board of health power to make rules and regulations, but unfortunately we have no money. So the board has done what it could in an educational way, through bulletins and the publishing in the newspapers of sane articles by various

members of the board of health. Smaller communities have been given articles on conditions as they are, how they are to be combated, and how to prepare heads and send them to the laboratory. We also give Pasteur treatment in the laboratory, using Public Health Service virus. We now average practically four cases a month. From 27 treatments given so far, we have not had a disturbing symptom.

We advise the authorities of the different communities as to the proper sort of ordinances to control the dog. We have been more or less successful in getting these ordinances passed, but we find a great deal of antagonism. We have almost come to the conclusion that if, in our present condition, we are to make any headway, we must permit the owner of a dog to take him for a walk under leash. Antagonism has been so great that we have almost had to concede this.

Now, State live-stock and sanitary boards have had money to spend, but the law has prescribed how it should be spent. Since March, 1915, this board has spent $73,000, all paid in bounties. In other words, they paid bounty on 29,200 coyotes. Now, the removing of 29,200 coyotes is undoubtedly helpful, but, gentlemen, coyotes do not constitute our epidemic.

We earnestly request that the Public Health Service enter into this campaign with Idaho. We have found that we can not cope with it alone. We shall again make effort at the next legislature to get special funds, having not been successful last time. I can say that Idaho favors any cooperative step in the control of this epidemic.

Dr. BEATTY. Mr. Chairman, I move that the time of each member be limited to 15 minutes.

(The motion was seconded and carried.)

Dr. J. J. SIPPY (epidemiologist, Kansas). The first known instance of rabies in Kansas was in Leavenworth County, where 8 cases occurred in live stock. Thirty or forty head of stock were killed. The next outbreak occurred in Allen County, an area of 2 by 5 miles being involved. The board of health records an outbreak in Sumner County in 1908 in which much more area was involved and more stock lost. One death occurred in my own practice. In 1911 we had an outbreak that involved the whole of Brown County.

We have not been able to obtain a very complete report from our different laboratories, but I have here statistics for the years from 1910 to 1915, inclusive, based on incomplete returns from 45 counties out of 105. The State board of health laboratory of the experimental station of the agricultural college reported 85 positives, the State laboratory 87 heads, of which 39 were positive, and the agricultural college 85 positives. These positives came mostly from the eastern half of the State. We have had very few cases in the western half.

There has been a total of 17 deaths due to rabies in human beings in the last five years.

Now, in the matter of treatment. Up until 1909 we had no place in the State where we could treat these cases, consequently a great majority went to the Chicago Pasteur Institute or to St. Louis. Since then we have been furnishing treatments at the State hospital, Rosedale, connected with the school of medicine. In the last three years the school of medicine has treated 109 cases, with only 1 death, due to the patient coming too late. In addition to those, quite a number of cases were treated locally by physicians, all of them with good results. The known number of persons infected has been 226, and of those 219 were given antirabic treatment. That does not include the deaths among those who had no treatment.

We have still with us a few of the old settlers who pin their faith to the madstone treatment for this disease. Madstone is a limestone formation to be found in the stomach of the white deer and is about as efficacious in treating rabies as the bits of a flowerpot.

Now, in the way of preventive measures. Our powers under the law are rather confused. In the first place, various cities have muzzling powers under city ordinances similar to those Dr. Woodward has mentioned. Secondly, county boards of health may establish regulations and quarantine districts. Thirdly, the State board of health may establish quarantine districts and enforce the muzzling of dogs. Finally, the live-stock sanitary commission may do the same. So, it being everyone's duty to look after these quarantine restrictions, it is no one's duty, and not until the public sentiment is widely aroused can anything be done.

There are other complications. Three years ago the legislature determined that a dog is personal property and must be listed and taxed as such. It devolves upon the sheriff of the county to kill all dogs not so listed. After a dog is killed the owner must be reimbursed by municipality, county, or State. For these reasons our results in preventive measures have not been very satisfactory. While there is not much public sentiment against the muzzling of dogs, that is simply because it has not yet been aroused.

Dr. W. J. Butler (State veterinarian, Montana). We of Montana are somewhat fortunate in that at the present time we have no rabies. We have investigated a number of deaths of live stock in the past few months, but in each we have found that some poison, such as strychnine, was responsible. Physicians in the field and officials from Washington both concluded that rabies was not present.

Our problem, therefore, comes down to the proper method of preventing the introduction of hydrophobia. We have no anxiety as to dogs, as we have quarantined against their importation into Montana since about 1910, when hydrophobia was first reported in these

western States. But it is absolutely impossible to prevent the introduction of rabies by coyotes. The Biological Survey have men employed for the destruction of coyotes and wolves and other predatory animals; but these animals scatter when hunted. Wolves in one night will cover over 150 miles of territory, and when you begin mixing into their range or run they depart from it. The Rocky Mountains do not stop them. Now, if the Biological Survey and the States of Utah, and especially of Idaho, Oregon, and Washington, are going to hunt coyotes and wolves, undoubtedly we will have rabies brought into Montana, unless there are hunters placed along the State lines to prevent the wolves and coyotes from scattering.

In Montana we have tried the bounty system for several years, the live-stock men paying upon live stock a tax not to exceed 3 mills. Out of this 1½ mills goes to the live-stock sanitary board, which usually cooperates with the health authorities in the case of diseases transmissible from animals to men, and one and one-half to the bounty fund. We have paid an average of something like $100,000 a year, sometimes running to $120,000 a year, for coyote and wolf pelts. As I have lived in the boundary counties for a good many years, I am pretty positive that 25 per cent of those pelts were shipped in from North Dakota and Wyoming. Seventy per cent of the bounties that we pay are for animals from our counties bordering adjoining States.

Our men are disappointed with the bounty system. A great many of them, especially cattlemen, now feel that coyotes should be inoculated with mange. I can tell you that it will kill them, particularly if the mange of dogs be transmitted to them. There is some objection raised on the part of the newspapers on the ground of cruelty, but coyotes also are cruel in their way of killing animals.

We find that where we have inoculated coyotes and wolves with mange they have practically disappeared. In the Powder River country, where we began this method about five years ago, you may ride to-day for two days and not see a coyote. There are several ways of inoculating these animals with mange. Direct inoculation has proven probably the most efficacious and best way. Coyotes are shipped to us and put into a cage with a scabby animal; then they are shipped to another part of the State, where they are set at large upon the range.

If male coyotes are inoculated and turned loose, the healthy males will kill them. My observation has led me to believe that the proper animal to inoculate with scab or mange is the female. An operation should be performed so that the animal will remain in heat, but not capable of procreation. Then she will run with a great many males and be a continuous source of infection until she dies. At the same time the male animals will seldom kill her.

Dr. A. F. DOREMUS (Utah State Board of Health). Does the Sta
pay for the dogs killed?

Dr. BUTLER. It has not so far. If an animal is found running
large in the street of a town contrary to the laws or regulations
that particular town, its owner would not be entitled to compensatio

I would like to have an expression on the part of this meeting as
this inoculation of mange in coyotes. There were some newspap
articles which stated that hydrophobia was introduced into the Sta
by means of this coyote inoculation. That, as you know, is absolute
impossible and should be denied by this convention.

Dr. S. L. LEE (secretary State Board of Health of Nevada). M
Chairman, in coming up this morning I left the data I had at t
hotel, not knowing we would proceed so soon to business.

Rabies first appeared in the northern portion of our State, I thin
in the latter part of 1914. From that time until the present Paste
treatment has been given in 45 cases. No deaths have been report
to me. The disease spread rapidly in Humboldt County. The lo
of live stock seems to have been about $100,000.

The stockmen of Nevada are in favor of cooperative action a
are prepared to guarantee themselves to the extent of practical
one-half dollar per capita; in other words, $95,000. I estimate th
there are 170,000 stockmen. The eradication of rabies, it seems
me, is a mere question of finances.

Dr. BEATTY. This is the proposition that is interesting us. We a
certainly threatened with an invasion of the disease, and it seems
me that it would be very foolish to wait until it is here before taki
action. Unfortunately, we do not have available the financial mea
to enable us adequately to grapple with the situation, and therefo
we are among the list of supplicants for Federal assistance. Appr
priations from Congress should be augmented by contributions fr
the live-stock interests which are seriously threatened. I am t
that they have contributed $20,000 in Nevada. Am I right, Dr. L

Dr. LEE. The data I have is that the cattle association will p
$10,000, sheepmen $10,000, counties about $50,000, and the St
$25,000, aggregating $95,000.

Dr. BEATTY. We have with us representatives of the live-stock
sociations of Utah, and I hope they may be able to give us assura
of assistance. Until the legislature meets I am sure that we will
unable to secure funds from the State, and I do not believe that
will be possible to do so through the county commissioners. The
fore, in my opinion, it is advisable to concentrate our efforts on
borders of the State that are immediately menaced, establishing
zone as wide as possible in which the extermination of coyotes a
unlicensed dogs shall be undertaken by the Federal forces, with s
assistance as may be secured. We are especially endangered by

son of the fact that many herds of sheep now ranging in Nevada will during the spring season be trailed across into our State. With them naturally will come the sheep dog and, trailing after them, the coyotes. We don't have a gambler's chance of escaping the invasion of the disease unless people are brought to realize the seriousness of the situation and the necessity for radical measures and provide the means for carrying them out.

Dr. T. D. TUTTLE (commissioner of health, Washington). Mr. Chairman and gentlemen, Washington has rabies, but not now so many cases as we have had. The first case in the State was introduced into Pierce County in 1912 by a dog from Arizona, I think. The character of rabies exhibited by this dog was uncommon, but the other dogs that were bitten developed the ordinary acute rabies. The disease was prevalent in this county, particularly in Tacoma, through the balance of 1912 and in 1913. Toward the last of 1913 it showed up in Seattle. The first case, fortunately, was one of those that would satisfy the most exacting as to diagnosis.

During the year of August, 1913, to August, 1914, of cases determined by laboratory examination to be positives (Negri bodies found) we had 108 in Seattle, 22 in Tacoma, 12 in King County outside of the city, or 142 all told. Of horses, cows, swine, etc., also, that had rabies there were 5 in Seattle, 36 in Tacoma, 11 in King County outside of the city, and "several" in Skagit County. The total number of animals clinically diagnosed by veterinarians as having rabies, the diagnosis of which, however, was not checked by laboratory tests, was 837; number of animals suspected of rabies killed without laboratory examination or clinical diagnosis by veterinarians, 126; number of persons bitten by animals suspected to be rabid, 41; number of persons bitten by known rabid animals, 110; number of persons who have received antirabic treatment through the health departments, 142; number of pasteur treatments furnished by the Hygienic Laboratory to the State board of health, 181; number distributed to city health departments and physicians, 157.

At the outbreak in Seattle an effort was made to muzzle dogs, but it met with opposition. Still we managed to get rid of a good many dogs. During the first year of the outbreak we impounded 2,715 dogs and killed at the pound 2,537. Dogs picked up that had died in the streets numbered 180. In the year 1913–14, 4,088 were impounded. Of these, 3,752 were killed. Three hundred and ninety-five dead dogs were picked up on the streets and 2,988 found in garbage. In 1915 Seattle examined 27 dogs' heads, of which 17 were found positive. No horses' or cows' heads were submitted for examination.

In the States outside of Seattle 32 people were bitten by dogs suspected of having rabies. In all of these treatments the cases were cured outside of the city by the State board of health laboratory. We

have had no trouble in the treatment. During 1915 we examined 2 dogs' heads, of which 8 were positive; 4 cows' heads, of which was positive; and 1 cat's head, which was negative. These were sen in from all over the State.

The disease is apparently pretty well scattered over the Stat from east to west, but is not so severe as formerly. We encourag people bitten by dogs that are suspected of being rabid to take trea ment and to submit the dogs' heads for examination. It seems im possible to make the examination until the dog bites a person. think the sheriffs and other police officers of Washington must b expert shots. I don't know how often they miss the dog, but whe they hit him they never miss his head, because when they turn th brain over to us there is nothing left to examine.

We sometimes have noticed reports in the newspapers of allege outbreaks. We had a very severe one just a couple of weeks ago i Ellensburg. A great many were reported attacked. We got hold o the first three dogs, and many other dogs were killed because the were supposed to be rabid. We examined five brains and found n evidence of any rabies. No attack had ever occurred.

We have some Government charges in this western country. The are delicate individuals. We can not touch them. They can o pretty much as they please, and every one has 10 dogs, more or les What is the use of killing the coyote and leaving 8 or 10 dogs fo every Indian? These dogs must be killed if we are to get rid o rabies.

Dr. W. A. WYMAN (State health officer of Wyoming). Mr. Chai man, we have no rabies in our State at present, so far as I kno In 1911 seven persons, two cows, and one hog were bitten by do supposed to be rabid. The people took the Pasteur treatment, an no further cases developed. I do not know of any case in the Sta since that time. I realize, however, that we are liable to have rabi introduced from adjoining States at any time.

I think our laws are pretty adequate. Our funds are not larg but we can depend upon the live-stock interests to assist us. We pa a bounty in Wyoming, through the counties, on coyotes, and a numb of them are destroyed every year in this way; but I do not suppo it amounts to very much in eradicating the animals. I am quite i terested in the idea of introducing mange disease into the coyo family; and it seems to me that, if it is practicable, as the gentlema who advocates it represents, it may help to solve the question.

Wyoming extends to you its earnest interest in this matter and i willingness to cooperate in any program that may be adopted by th conference.

The CHAIRMAN. Is there any other State or any other delegate th has not been represented in the discussion thus far? [No respons

We have with us, as previously stated, representatives from the Department of Agriculture. We are especially fortunate in having present the Chief of the Bureau of Biological Survey, Dr. Fisher. I should like to ask him to discuss this subject from the economical standpoint and from the standpoint which his bureau represents.

Dr. A. K. FISHER. Mr. Chairman and gentlemen, for a number of years our bureau has been carrying on campaigns against noxious rodents, such as prairie dogs, ground squirrels, and gophers, which destroy farm produce, orchard and nursery stock, and forage plants. We have cooperated extensively in attempting to exterminate prairie dogs and ground squirrels in the national forests. Two years ago Congress appropriated a certain sum for experimentation and demonstration in connection with the best methods of controlling predatory animals which prey upon the live stock of the country and destroy the larger native game animals. Beginning with July 1, 1915, we were given the sum of $125,000 to carry on a campaign for the extermination of the predatory animals—including wolves, coyotes, mountain lions—on the national forests and other public domain. Included was a certain sum to be used in demonstration work in States that had no public domain or national forests. The whole territory was organized into districts, each under a competent inspector, who has charge of a corps of hunters and trappers. Although $125,000 is a large sum, when spread over all of the United States west of the Mississippi no considerable amount can be spent in any particular area.

When rabies became an important issue in Nevada the Secretary took the matter up with the bureau and arranged to place as many men as possible in the affected area, not only in Nevada but on the edges of California, Idaho, and Oregon, so that all possible could be done to assist in eradicating the disease. At the present time there is an emergency bill before Congress which, if passed, will carry the sum of $75,000, to be used between now and the 1st of July.[1] For this work we have an organization to which we can, upon almost a moment's notice, add a large number of hunters, with a few additional inspectors. To prevent any break in these activities the Secretary has planned, I believe, to ask for an additional $125,000, which will be available at the beginning of the next fiscal year, July 1.

We are making an attempt to get the very best men—those most interested in the work—and our inspectors are on the lookout for good men to supplement our present force, as soon as the money becomes available, on the western and northern frontiers of Utah, as suggested by Dr. Beatty, and in other places where they will be most effective in controlling the spread of rabies.

[1] This bill was passed by Congress and $75,000 was made available until expended.

You probably are aware that the bureau has adopted a system o having paid men. We pay them a certain amount, and they ar very carefully regulated by your inspectors, so that those who d not make good are immediately replaced by more effective me In that way we are having very encouraging results.

I was interested in what the gentleman from Montana said i regard to mange. He knows, of course, that mange is a diseas which has always affected the coyote and wolf, and that the wol mange is somewhat different from the dog mange. In our opera tions we find a certain percentage of mangy wolves throughout thi range, and in a great many cases the skins are valueless. We hav a very good ally in this work in the fur hunter. Of course, like th men who collect bounties, the fur hunters operate for a very shor portion of the year only, when the fur is in its prime, while ou most effective work is after that time, when the animals are wit young. On account of present conditions, the value of fur has mor than doubled during the present year. This fact has brought great many hunters into the field, and many thousands of coyot wolf, and other predatory animal skins are finding their way t the general fur centers. In fact, the subject of fur values is quit an important one in the eradication of our predatory animals.

We have been very successful in finding the dens, and our inspec tors are vitally interested in that line of work. In some of the dis tricts they have dogs trained to lead to the dens. If a female tha is nursing is captured. a drag is attached to that animal, and the by placing a hound on her trail the hunter is led to the den.

I agree with the gentleman from Washington, that we have a ver serious problem in the Indian dog; and we have one also in the dog that are generally at large throughout the thinly settled portion of the country. Along that line I believe that the Public Healt Service, the boards of health, and others who are assisting and coop erating are doing a vast amount of good work. The Biological Su vey has no authority along regulatory lines with reference to do mesticated animals; and, although it will be very glad to cooperat in regard to the stray dog out in the country, or the stray coyot where we operate against coyotes, I believe that more effective wor on dogs can be done by those authorities who have power and wh can arrange for ordinances and other means of control.

I feel that it is hardly necessary for me to say that the Biologic Survey will be glad to cooperate to the fullest extent in curtailin and attempting to eradicate this disease which is endangering huma life and which is causing such enormous loss among live stock.

The CHAIRMAN. We will be glad to hear from a representativ of the Bureau of Animal Industry.

Dr. H. J. HAMMOND. Mr. Chairman, the Bureau of Animal Industry has very little to do with this work, except in a supplementary and perhaps quite general way. We have very little authority within the States. However, I might say that in a few States we can exercise a good deal of authority in cooperation with the State sanitary boards; and we are to some extent doing that in Idaho, California, and Oregon. That is about all that we can do under present conditions.

The CHAIRMAN. Mr. Du Bois, of the Bureau of Forestry.

Mr. C. DU BOIS. Mr. Chairman, the Forest Service is interested in this work, as it directly affects the cattle interests on the national forests. The Forest Service also has authority by law and regulation to cooperate with State officials in any work which makes for the betterment of the administration of the national forest or the administration of the ranges within them.

It was my privilege, in cooperation with the State Board of Health in California, to assist in the actual organization of control work in an area badly affected with rabies, Modoc County. We found there that the paper blockade was not effective until an organization from outside of the county had been established. In any given unit of area there are a great many agencies at work, including the county health authorities, the State health authorities, the Forest Service, Biological Survey, Public Health Service, the sheep and cattle associations, and the general public and the police officers of the county. An attempt was made to create an organization which would take advantage of the positive help of all of these agencies and have each agency do what it was best capable of doing. We appeared before the county board of supervisors, told them what the situation was in their county, and were assured of their cooperation. Certain ordinances were passed at our suggestion. Local town authorities, in places large enough to have effective town organizations, immediately took charge of the enforcement of quarantine regulations. Outside of the towns the men paid by the Biological Survey assumed charge. The deputy health inspectors of the State were also in the field. So far as possible the authority was exchanged and correlated so that any man, no matter by whom he was paid or to whom he belonged, enforced the dog quarantine regulations. In connection with his other work each ranger acted in his territory as supervising inspector over the trappers, some of whom were paid by the State and some by the Biological Survey.

So much for the actual field organization.

The big work was yet to come, and that was the education of the people of the whole county as to the exact situation, and the danger of rabies getting among their live stock, for the purpose of securing their active, earnest cooperation in the work. Here the

forest rangers were of considerable service, because of their personal knowledge of, or acquaintance with, the citizens of the county through their regular work of taking stock applications. They met practically every citizen of the county, explained to them what was going on, and enlisted them in the general campaign, and distributed free poison furnished by the State board of health. Newspapers were enlisted in the campaign. Articles—"sane" articles, as our friend from Idaho says—were furnished the editors of all the newspapers. These described in specific terms the situation. A lecture tour was carried on by the officers of the State board of health and the officers of the Forest Service in every town and settlement in the county. We found no difficulty whatever in enlisting public support for the movement. A significant fact was that the Modoc Woolgrowers' Association circularized their membership, urging cooperation in the work and saying that they expected each one of their members to instruct his herders to handle sheep on the range without dogs, though they knew perfectly well that it would cost more money and cause considerable difficulty. They realized that the sheep dogs on the range were the most liable to come into contact with infected coyotes.

As the net result of the whole work, I have every reason to believe that Modoc County can be discharged cured in about six months. And I believe that in any county where a similar organization is placed, where every possible agency cooperates to the fullest extent, where there are no fine-haired distinctions between authority and funds—in other words, where everybody chips in and works for the same object—there is going to be no difficulty whatever in controlling this situation.

Dr. BEATTY. Mr. Chairman, there will be a meeting during and after dinner at the Alta Club this evening at 7 o'clock, and I desire to invite all members of the conference to be present. The occasion will be entirely informal, and we trust you may all attend.

The CHAIRMAN. If there is no other business, we will adjourn until 2 o'clock.

AFTERNOON SESSION.

RABIES—CONTINUED.

Dr. D. N. ROBERG (secretary Oregon State Board of Health). Rabies first occurred in our State late in the fall of 1910. From that time up to the present there have been 279 heads sent in for examination. Of these, 139 were positive; 140 negative. Twenty-one counties have been affected.

From January 11 to November 13, 1915, 71 human beings were treated for rabies. None of the 71 animals which had bitten them showed negri bodies. In only a very few instances were we able to

make an examination of the brain, but the history and clinical symptoms of the dog or wild animal showed rabies to be present. Of these 71 human beings 2 received treatment too late. At the present time we have rabies in cattle in Klamath Falls. The outbreak commenced two or three weeks ago and 23 head have died so far.

Technically, our State is comparable with the other States, and a detailed description of conditions there will essentially conform to other reports presented to the conference. We have made an effort to increase the bounty in Klamath County to $11.50. Increasing the bounty on coyotes, however, has not been of much value, as we have had definite information that trappers who trap coyotes merely for the bounty allow the litter of females to go in order to increase their profits. At the last meeting of our live-stock board it was suggested that ordinances be drawn up by the State health officer and the State veterinarian and distributed to each municipal government, these ordinances to be put into effect in the event of an outbreak of rabies. These will be distributed within a month or so.

Mr. GEORGE B. RUSSELL, Jr. (of Nevada). It certainly affords one who has been in the seat of the rabid district great pleasure to be here this afternoon and listen to the enthusiastic manner in which the delegates have pronounced themselves, more especially those whose sections have not been visited by this disease.

I can advance nothing here from a scientific point of view; what I say is merely from the standpoint of a stockman. After great deliberation we found that there were three things to do if we wanted to be successful in battling with this disease: First, the dog must be absolutely controlled; second, we must exterminate the coyote; third, we must have assistance from our neighboring States.

It is a hard proposition to control the dog, but I will state what we have done in Nevada. We have passed ordinances in our various counties that every dog running at large on the street, whether muzzled or not, is to be shot by an officer; and they are being complied with. Of course, a great many people do not like it, but when they see the seriousness of the thing they do not make any objection.

Secondly, the coyote must go. We have had a conference at Winnemucca, at which some of the Federal officials and a number of our own people were present, and the question came up as to placing a high bounty on the coyote. This method was favored at that time, but we found later that it would be better to organize the State and pay men to go out and trap. Through this means we could get assistance from the Biological Survey of the Government. The high bounty would work well under certain circumstances, and then again it would not. The proposition offered by our friend from Montana[1] is one which I intend to take home with me.

[1] Eradication of coyote by introducing mange.

Nevada is the battle ground of the rabid coyote; it is there that th coyote must be met. If men are put along the borders to keep thi disease from spreading among other States, it will save a great man lives and hundreds of thousands of dollars worth of property. urge upon this convention, even upon those delegates from State not affected with the disease, to take steps to combat it, because whe it does find access it is so serious a matter. The State of Nevada wi very eagerly cooperate with the Federal Government in doing all can to exterminate this disease, and will meet with open arms th people of our adjoining States in order to wipe it out.

Mr. L. F. KNEIPP (district forester, Ogden, Utah). Forest Servic District No. 4 comprises all of Utah, all of Idaho south of th Salmon River, practically all of Nevada and most of wester Wyoming. The national forests in this district cover a gross are of 29,000,000 acres; I think that is about 13 per cent of the total are within the district. In that district we have a regular field force o 225 men, which is augmented during the summer months by abou 125 additional men. That force is at the disposal of the differen agencies working for the eradication of rabies, and it is our desire, s far as possible, to duplicate what the Forest Service has already don in northern California. We are pretty well organized, and we have fairly good bunch of men—men, I think, who can be depended upo in enforcing any ordinance or regulations which might be promu gated by any of the State or county authorities. They will work t the very best of their ability.

A great deal of emphasis has been laid on the fact that the cryin need is money; but I wish to raise the question as to whether mone is the only essential. We have the Forest Service with a field for in this district of 225 men; we have the State game departmen of Idaho, Utah, and Nevada, probably 100 all told and perhap more; we have something like 50 members of the Biological Survey we have a number of Red Cross chapters here that would u doubtedly take a very active interest in this work if it were pr sented to them; and we have very many men in the health d partments. If an organization could be effected that would consol date all these various interests in this work and outline definitel the best course of procedure, it would not take so much money get results. The stockmen, I believe I am safe in saying, are almo a unit in wanting to take up this work, partly from the standpoi of pure public service and human welfare, but very largely from a economical standpoint.

The loss this past year in the national forest was about 40,0 head of sheep killed by predatory animals, making an econom loss of about $200,000. In addition to that there were almost 5 head of cattle killed, which are worth on the average $40 a hea

and, I think, 29 head of horses. Now, this loss occurred only within the national forest during the comparatively short summer season of from three to five months. The number does not represent by any means the major portion of the loss sustained by the live-stock industry. The stockmen realize the necessity for action on their part, and where organized they are doing practically all that they can at the present time. I know that a number of associations are taxing themselves as high as 2 cents per head of sheep in order to provide funds from which they can supplement the State bounties, and they might perhaps raise the taxation to 3 cents or 5 cents if properly approached. I think, as a matter of fact, they are pretty nearly doing their share now.

The crying need at this conference is an organization which will get the most out of these various interests that should take an active part in this work and provide a plan of campaign that would secure the utmost assistance from the means available. I wish to announce that in anything that is done here the Forest Service is willing to go the limit to assist and cooperate in the work.

Dr. BEATTY. I agree with the gentleman who has just spoken in that we should effect an organization and plan of cooperation at this conference. This was one of the reasons for suggesting the meeting. We in Utah have had no experience in combating rabies, and thus far each State affected has been forced to grapple alone with the problem, which, in fact, is one requiring combined action. Coyotes recognize no State boundaries, and the final elimination of rabies involves the practical eradication of coyotes. The Biological Survey is best equipped for this purpose, and I think we must all agree that it should supervise and coordinate the work in the various States, aided by the local forces.

Dr. F. F. GUNDRUM (of California). I want to go into the California situation just a little bit further and show you what I think is the first requisite to handling this problem from an economic and health standpoint. The Forest Service, Biological Survey, Public Health Service, etc., have their certain duties and certain regulations. By unification of these Federal services with the California State Board of Health we have made the officers of one the officers of another, so that one man may have a whole string of badges like a Russian military officer, and be able to take the whole rabies situation in hand in any given area.

I think that one of the first duties of this convention should be to make it very plain to the States involved that it is up to each one to get some sort of a reasonable law, so that the State board of health can handle the situation through quarantine or through some sort of arrangement such as we have in California.

Dr. LEE. I fully concur in the necessity of combined action. As the gentleman from California stated, the Government should be imbued with the importance of the situation, but the State is absolutely helpless. The county commissioners, on the other hand, can levy taxes. It is true that you will probably meet with the same trouble that we met with in Nevada—the counties which are remote from the ravages of rabies will probably not be interested. However, if you can get a tax of 3½ cents over the property tax, you will not have to wait to ask money from the legislature.

Mr. DELANEY. The remarks of our friend from Nevada (Dr. Lee) will apply very well in his State, but I doubt very much if they will apply to the laws as they now stand in most of the Western States. I think there are a very few States that will avail themselves of legislative action. If you do it by taxation, that will undoubtedly serve the purpose. As to the providing of funds by the county commissioners, I know that in two or three of the States they did not have the power to levy special taxes, and the legislature met to give them that power.

Referring to the Government's going into the States to work, it is well known that no Government official can do so without authority from the States. Two or three States have made it a misdemeanor to turn loose any predatory animal when once captured. It is a question whether or not the female coyote should be turned loose and allowed to go back to the den in order to trap the rest of the coyotes.

Mr. JAMES H. MOYLE (Salt Lake City, Utah). Mr. Nehlitt, of Wyoming, was elected to prepare a statement, but he could not be present. I will therefore take the liberty of reading what he says in a letter:

GRANGER, WYO., *January 28, 1916.*

Mr. JAMES H. MOYLE,
Salt Lake City, Utah.

DEAR MR. MOYLE: * * * I am inclosing herewith some letters and data relative to the amount paid out as bounty and the number of coyotes killed in various parts of the country. * * * We wrote a great many letters to county clerks, county and district associations, individual woolgrowers known to be interested, and State officials, asking for information as soon as possible but so far have received but few replies * * *. In addition to the inclosed I beg to state that the Lincoln County Woolgrowers' Association, with headquarters at Cokeville, Wyo., during 1915 paid bounty on over 2,100 coyotes that were killed in the county and along its immediate borders * * *. The bounty ranged from $1.50 to $2.50. This number was caught prior to December 1, 1915. Since that date we have paid for over 500 more and have more and better-equipped trappers and hunters in the field now than ever before. Our efforts and liberal bounties have influenced many of our neighbors on all sides, and large numbers of coyotes and wolves are being caught. At Soda Springs, Idaho, immediately on our west, more coyotes were caught in 1915 than in five years previously. There are lots of coyotes left, even in the district

where so many have been killed, but I shudder to think of their numbers had we not killed any of them.

For my part I am very glad to see the Government taking an interest in the destruction of predatory wild animals, but I would not like to see the bounty system discontinued or discouraged in the least until it has been thoroughly demonstrated to us that they have a better plan.

After 25 years in the sagebrush districts of the West I can truthfully say that I never knew coyotes to catch a jack rabbit, and I believe one old Maltese cat or 10 cents' worth of prepared poisoned bait will destroy more prairie dogs or ground squirrels than the best hundred coyotes our Uncle Samuel ever raised "for their fur and the rabbits and prairie dogs they might kill."

Poisoning is absolutely the best way to get rid of the coyote, and if the animal is skinned promptly the fur is not materially injured, if at all, by the effects of the poison. There is, however, considerable prejudice among professional trappers against the poisoning system, for the reason that many poisoned coyotes travel some distance after picking up the poisoned bait before they die, and a little fresh snow covers them over and makes them hard to find in time for the trapper to realize on the fur. When we pay bounty on one coyote that has been poisoned, we figure that at least five more are lying dead in the brush and snow for which we will not have to pay.

Our trapper poisoned some horse flesh near his camp one winter and secured a number of dead coyotes as a result, and the following spring we found the carcasses of 24 more coyotes that had evidently been poisoned by the same bait.

We save the blood when butchering, mix it with lard and tallow, make into balls about the size of a walnut, insert about 3 grains of strychnine into it, and place it along the trail where we drag behind the rig a chunk of any kind of meat on our trips. A little prepared scent also seems to help to attract the coyotes to the trail. It may be that some professional trappers do not use poison according to instructions when compelled to use it at all, and the best remedy or protection I know of lies in individual effort by the stock owners or some trusty who will do as told.

Coyotes are very bad during the lambing season in our country, and we have had splendid results by having a man look up their dens and dig them out about the time the young ones are born. A mother coyote will probably destroy more lambs during the first month after her young are born than in all the rest of the year.

Cooperation between the Government and the States and the people, large bounties, liberal treatment to hunters, and individual effort on the part of the growers of live stock and poultry constitute, in my opinion, the best way in which to deal with the question at this time.

With kind regards and much respect, I am,

Very truly, yours, J. D. NEHLITT.

There are a number of letters here; one, for instance, from the interstate executive committee of the Texas Sheep and Goat Raisers' Association, in which they say that since the new law was passed in 1911 they have paid out $577,000 in Texas on claims for the killing of predatory animals.

In coming to the building with Dr. Murray, he said that he estimated from the best information he could obtain that there is a loss

of about 6 per cent from coyotes. The people with whom I am associated in the sheep business make the same estimate.

I regret extremely that Mr. Nehlitt was unable to be here, because he is a practical sheepman with very many years' experience, and has taken a great deal of interest in the rabies question.

Dr. WOODWARD. For the information of a good many of those present, Mr. Chairman, I think I ought to make it clear that I am not an officer or agent of the Federal Government, so that I can say nothing for which the Federal Government is in any way responsible. It seems to me, however, from what I have heard, that the great difficulty in the situation lies in the absence of the correlation of the various forces that are at work.

So far as the killing of predatory animals is concerned, I doubt very much whether the injection into the situation of those engaged in public-health work with respect to human beings would be helpful. There has certainly been shown here two aspects of the problem: (1) The disease in domestic animals and human beings; (2) the disease in the predatory animal and in stock. With respect to the domestic animal and human beings, we have provided by Federal statute a system that is capable of doing, and I think is doing, good work. I refer to this very conference, which is held annually and also at the request of the States, as in this case, to consider matters relating to the public health. But, so far as I know, there is no law calling for a conference in relation to the destruction of predatory animals. Such a law is needed as the first step toward solving this problem. The conference should be called either by the Secretary of Agriculture or by the agents of the States which are interested in the question of predatory animals.

As has been stated two or three times, however, the Federal Government can not act without the consent of the State, except in relation to land actually owned by it. There is, therefore, a great question in my mind as to just why the Federal Government should be called upon to appropriate large sums of money for the elimination of predatory animals for the protection of stock, except as these animals may find refuge for propagation on Federal territory. Of course, the question is at once raised as to the duty of the Federal Government to protect all industries, including stock raising. That is one of the functions of the Federal Government under the "general-welfare clause" in the Constitution; but it is quite as much the function of the State government to protect its own industries.

Something has been said here with respect to the lack of appropriation. That exists with respect to this problem as it does with respect to all. Thus the problem is not alone one of cooperation but involves the securing of legislation and appropriations, including

the securing of constitutional amendments, so that your industries and the lives and health of your citizens may be protected.

What we need now is an organization of the agencies already in the field which handle the problem from a broad standpoint and with standard methods.

Dr. BEATTY. Has the Federal Government the power to promulgate a regulation prohibiting animals from being taken from one State to another? One that would prevent sheep dogs from being brought into our State from infected areas?

The CHAIRMAN. I think that the act of February 15, 1903, might be a basis for a regulation of that character. Such a regulation would have to be submitted, of course, to the Department of Justice; but that would not prevent this conference from making such a suggestion.

Dr. BEATTY. I move that it is the sense of this meeting that the Public Health Service promulgate such an order on the request of any State, and that we recommend to the resolution committee, first, that the destruction of predatory animals shall devolve upon the Department of Agriculture in cooperation with the State authorities and commercial interests within the State; second, that the prevention of the disease among human beings, including the control of domestic animals and prophylactic measures, shall devolve upon the Federal and State health authorities; third, that the health authorities be requested to adopt regulations to control rabies in counties; fourth, that the Public Health Service be requested to detail an officer to cooperate with the State health officers in stimulating local activities.[1]

(The motion was seconded.)

The CHAIRMAN. Any one of the resolutions can be discussed, after which they will be referred automatically to the committee on resolutions.

Dr. TUTTLE. It is my understanding that most of the States, especially the Northwestern States, may issue regulations, or the governors issue proclamations, prohibiting the importation of domestic animals. It is one of the regulations of the Secretary of Agriculture that all health certificates issued by any official of the Bureau of Animal Industry must be in conformity with the laws of the States to which live stock is destined. As a result, each particular State may quarantine against any live stock coming from any other State. I also believe that the Bureau of Animal Industry can prevent the importation or exportation of live stock; if not, the State, at least, can. Montana prohibits the importation of dogs from States affected with hydrophobia.

[1] See pp. 52, 53, for resolution finally passed by the conference.

Mr. DELANEY. This matter comes under the live-stock law of 1884 so far as the infection of a community by disease of animals is con cerned, and also under the act of 1905, which has been interpreted by the courts as giving the Secretary of Agriculture the power of pro hibiting the interstate movement of live stock and domestic ani mals which are known to have been exposed or have any indicatio of disease. Every State has the inherent right to demand of th Federal Government protection from outside forces; but, of course we must look to the State to do a great deal of the work of prevention

The CHAIRMAN. Would you, then, amend that resolution to includ the Bureau of Animal Industry with the Public Health Service i the control of the diseases of animals? If the former bureau ha that authority, they will exercise it, and we will be glad to recogniz their regulations in the same way as is now done in the case of ou foreign quarantine regulations.

Mr. DELANEY. That was my object.

The CHAIRMAN. If there is no objection, Mr. Delaney's amend ment will be submitted to the resolutions committee with Dr. Beatty' resolution.

ROCKY MOUNTAIN SPOTTED FEVER.

Dr. L. D. FRICKS (surgeon, United States Public Health Service) In rabies we have been discussing a disease which is as much a dis ease of animals as of man; but in Rocky Mountain spotted fever w have a disease which is not transmissible to the larger domesti animals. Horses and cattle are not themselves subject to the disease but they may breed the infection. Thus, although the problem ma be approached from different angles, the disease is primarily one o human beings.

The disease is transmitted to human beings by the bite of an in fected wood tick, the tick requiring about two years to complet the cycle from adult to adult. The tick lives on the smaller animals such as ground squirrels, prairie dogs, and chipmunks, during it immature stages. The control of the disease, then, means primaril tick eradication. In the most heavily infected areas differen measures have been adopted to this end, such as cultivation of th land, burning over of the foothills where the ticks are found, dippin of domestic animals, and killing of the small animals that serve a a host for the immature ticks.

The cultivation of the land will take care of itself. Where this i being done over large areas the ticks will be entirely eliminated but in land not under cultivation Rocky Mountain spotted feve appears to be at present a problem of control rather than of entir eradication; that is, it is more like the malaria problem than th plague problem.

The killing of the small wild animals has been carried on successfully by other branches of the Government and by individuals throughout the Northwest, and it is to my mind a very profitable field for work, for the reason that it accomplishes several objects in one. Where property owners cooperate it is less expensive than some other measures adopted.

The dipping of domestic animals is not so effective with this disease as with Texas cattle fever, for this tick does not stay on the large animal host during all of the stages of its development. Its immature form will be found on the smaller animals. Three stages of the tick can not be destroyed with one dipping, as in the case of the tick infected with Texas cattle fever. Dipping is certainly justifiable in certain localities infected with Rocky Mountain spotted fever, but it is very doubtful whether it is applicable over the entire territory affected. The expense is prohibitive. It is doubtful if a dipping vat with corrals can be constructed for less than $750. The radius of the area worked from the vat would have to be about 5 miles. The continuous use of the vat will also require the service of a very competent man to get the arsenious solution the proper strength, as the simple running of a horse or cow through a dark-colored solution is not at all sufficient.

In the Bitter Root Valley the Public Health Service has been carrying on some experiments in sheep grazing in regard to tick eradication, the idea being that this plan, if feasible, could be carried on without expense to the Government or State. We have also found that adult sheep of the mixed Merino variety have considerable grease in their wool, which under favorable conditions will kill from 85 to 90 per cent of the ticks that attempt to attach themselves to the sheep. The ticks crawl into the wool and are suffocated by having their breathing pores filled up with grease. Another thing is that sheep driven closely over an area will pick up practically all of the ticks on the area. Still another is that ticks do not breed readily on sheep. This method is not effective with sheep that have been poorly wintered, and consequently have little grease in their wool, nor is it effective with lambs, as the chances are that the ticks will not die on them. I would not like to say that the grazing of sheep will entirely eradicate tick infestation in every community, but three years of experiments have conclusively proven that it can be so carried out as to reduce greatly the tick infestation.

Other work of the service has been along the lines of determining the areas of infection of this disease. In general, this work has been carried on for three or four years, though in Idaho since 1908, I think. Although the disease has been attracting considerable attention in the Northwest, the figures we have obtained do not show a great

prevalence nor a very great average mortality in the cases reported. In 1915 California reported 2 cases; Idaho 360 cases, with 10 deaths; Colorado, 14 cases, no deaths; Montana, 14 cases, 7 deaths; Oregon, 46 cases, 4 deaths; Utah, 31 cases, 3 deaths; Nevada, 8 cases, 3 deaths; Wyoming, 54 cases, 8 deaths; and South Dakota, 2 cases—a total of about 570 cases, with 36 deaths. These reports were obtained through the State health officers, and I am sure they are fairly accurate, much more so than the reports we receive of measles and scarlet fever from all over the United States. I believe that in Nevada and Utah the health officers have not received full reports. Nevada reports 8 cases, with 3 deaths, but according to the mortality rate in Idaho, and we have no reason for believing that it is less than in Nevada, there should be 100 cases to 3 deaths in the latter State. The same reasoning can be applied to Utah. As you see, the mortality runs from 3 per cent in Idaho to 50 per cent in Montana. The determination of the area of infection is important, since we can not do any thorough eradication work until we find out where the disease is present.

Apparently the only means by which the disease can be spread is through ticks being carried on animals, mostly horses and cattle, since the tick itself does not travel, and the smaller animals, which serve as a host for the immature tick, travel no very great distances. Some of the wild animals which carry the adult ticks probably travel long distances, but the chief means of spreading the disease at present is through domestic animals, which are driven numbers of miles or are shipped on trains.

The work of the Public Health Service has also been concerned with the determination of the virus of Rocky Mountain spotted fever. We know that it is a living organism and that it will pass through an ordinary filter; therefore we ought to be able to see it, but heretofore it has not been discovered. In carrying on his laboratory experiments, by moderate dilutions and centrifuging for several hours, Dr. Rickets, whose work you are all probably familiar with, was never able to throw down the virus from the blood. The difficulty, as I have found, was that he did not use a sufficient dilution. Recently I have had occasion to attempt to eliminate a contaminating organism from my spotted-fever virus by means of the centrifuge. I used a much greater dilution than did Dr. Rickets and obtained a very different result. Using one part of infected guinea pig blood or serum diluted with 10 parts of normal salt solution, I was able after six hours' centrifugation completely to throw down the spotted-fever virus.

The injection of the upper part of the centrifuged dilution produced no effect on a susceptible animal, while 1 drop or less from the sediment produced spotted fever. From this sediment I was

also able to find in the red-blood cells and also without the cells, after incubation, small protozoon like bodies, some of them 1 millimeter in diameter. I repeated this experiment a number of times and have never been able to find the same organism in blood that is not infected with spotted fever, and for this reason I believe that we probably have found the organism which is responsible for this disease.

The points that we are particularly interested in at this conference, I think, in regard to Rocky Mountain spotted fever, are the determination of the areas of infection, the question of the movement of live stock from State to State or within the State during the tick season, and the eradication of the smaller animals. It seems to me that by furnishing poisoned grain to the ranchers, or poison to be used on grain, much can be done in this eradication. In the different branches of the Government they are using this method and have used other methods for the destruction of small animals.

I am convinced that, unless we take some measure for controlling tick infestation, the next two years will see a considerable increase in the disease.

Dr. F. E. MURRAY (Bureau of Animal Industry). I notice that the Bureau of Animal Industry expects to do some work along this line. The control of the larger animals, I think, has been invariably done in connection with the Public Health Service. We are dipping animals and doing similar work in the South at the present time in the eradication of the Texas fever tick, which belongs to the same family as the spotted-fever tick, but is a little more difficult to eradicate. We are also doing some work now in the southwestern corner of Idaho for experimental purposes relating to the eradication of spotted fever. But I would suggest that the matter be taken up with the Secretary of Agriculture.

Dr. WYMAN. During the last year, at Dr. Fricks's suggestion, we took this matter of Rocky Mountain spotted fever up with the health board, which issued forms by which our local health officers could report the number of cases. I am able to increase the number which Dr. Fricks reported in Wyoming to 61, if my memory serves me correctly. I did not know the matter was going to come up at this time and did not bring any data; but I think 61 cases were reported, and something like 9 deaths.

This disease is in its incipiency. From what I can learn, it started in the Bitter Root Country, and it has been gradually spreading. In Wyoming it has spread over a half dozen counties. It seems to spread along the course of the streams, indicating to me at least that it is carried from one locality to another by domestic animals.

It is a matter that the health officers should take up. The time to find the proper method of eradicating it is now, before it gets to be

a widespread calamity. I hope most earnestly that Dr. Fricks will succeed in finding the organism that is producing the disease, so that we can work more intelligently in its eradication.

Dr. LEE. I would like to ask if the history of afflicted persons shows that they have been largely among sheep shearers and sheep herders.

Dr. W. N. McGILL (representing the rabies commission of Nevada and the National Wool Growers' Association). So far as my knowledge goes, the disease is unusual among sheep shearers, but among sheep herders it is of frequent occurrence. To my mind this is because the herder goes out into the bushes where the infected ticks are.

Dr. TUTTLE. We have received many letters from physicians asking where they could get literature that would help in making a diagnosis of cases of spotted fever, and I wish at this time to suggest to the Government that a brief pamphlet be issued setting forth the elements of diagnosis for the use of health officers in the States.[1] Two physicians tell me that they undoubtedly have had cases of spotted fever, but did not find out until I had written them personally what I knew about the diagnosis of the disease.

Dr. BEATTY. There is no question but that spotted fever has become increasingly prevalent in Utah during the past 10 years. Cases are more numerous and the area has been greatly extended. Even during the past year they have been discovered in parts of the State where they were never found before. It is a matter of vital interest to this State and preventive measures should be adopted.

That brings up a rather interesting question. We are here primarily to consider the extermination of coyotes. Now rodents have been discovered to be hosts of the spotted-fever tick, and war has been declared on them. We are therefore going to destroy one of the most effective exterminators of rodents by the extermination of the coyote. It is very unfortunate that the coyote should have chosen this time to become infected with rabies.

In view of the fact that Dr. Fricks's discovery has been reported for the first time at this conference, and in view of the far-reaching importance of the discovery which he has made after many years of persistent endeavor to discover the cause of organism responsible for the disease, I feel that it would be fitting for this conference to pass a resolution congratulating Dr. Fricks on his discovery. I move that such a resolution be prepared.

Dr. LAUBAUGH (of Idaho). I wish to second the motion of Dr. Beatty. I know a little something of the work that Dr. Fricks has done in Montana, and I certainly wish to join the organization in extending my congratulations to him on the successful outcome of his

[1] Issued Mar. 17, 1916, by the Public Health Service as Supplement No. 28 to Public Health Reports.

investigation. I believe that we hardly realize the importance of this discovery. Idaho has more than a passing interest in Dr. Fricks's work, as it is of vital interest to her—vital because within the past six years she has had 1,746 cases of spotted fever, with 59 deaths. Idaho not only feels that she should request that Dr. Fricks continue his work, but feels that she has sufficient grounds for making this request a demand.

The CHAIRMAN. Without objection, Dr. Beatty's motion will be referred to the resolutions committee.

Dr. L. D. FRICKS. I should like to take issue with those speakers who believe that by dipping domestic animals we could get complete tick eradication. I certainly hope that this might come and it may after a number of years, but in the present condition of affairs in the Northwest, the immense territory involved, I can see no possible hope of a complete tick eradication by any measure now known, and certainly not by dipping horses and cattle over an extensive area, as it is absolutely prohibitive in cost. As I stated, I think it might be possible in very circumscribed districts. I think that so long as we have small animals on our ranges we can not expect complete tick eradication.

Dr. D. N. ROBERG. I have recently taken office in Oregon, but have as yet had no personal experience in that State. We have a great number of responsible physicians, but they are scattered. Methods of spotted-fever eradication should be brought to the attention of the physician first hand. I spoke to Dr. Rickert in regard to this matter, and he suggested sending a man through on a lecture tour. We could get the physicians together in the different centers. This tour could be planned, I am sure, and it would be of great help in getting better reports of the disease. I am certain that we are not sending in the reports that we should.

Dr. BEATTY. Dr. Roberg's suggestion is an excellent one, and Utah would like to have the benefit of it. Therefore I move that the Public Health Service be requested to detail one of its members to visit the various States interested, to lecture and give instructions as to the diagnosis of the disease and other important factors in its eradication.

Dr. J. H. CLEMMONS (of Nevada). It seems to me that work can be done along the line of distributing leaflets among the people, so as to educate them as to the danger of the tick bite. Most people do not pay much attention to the bite if out on a trip, waiting until they get home before removing the tick. If the tick is removed immediately before the blood has become affected, which I believe can be done in most cases, the spread of the disease could be materially lessened. It seems to me that this question is largely a matter of education.

The CHAIRMAN. I will say that two or three officers of the Publi Health Service have been in the Rocky Mountain States during th last year or two studying this disease, and that it will be quite pos sible to furnish literature to the various physicians. Also, arrange ments can be made with these officers for addresses or conference with the physicians. If request is made from the health board to th Surgeon General, every effort will be made to comply.

Without objection, Dr. Beatty's motion will be referred to th resolutions committee.

MIGRATION OF TUBERCULOUS PERSONS.

The CHAIRMAN. For some years the subject of migration of tuber culous persons in interstate traffic has engaged the attention of thos interested in the health of this country, and particularly that of th National Association for the Prevention of Tuberculosis. In re sponse to a resolution passed by that association, officers of the Publi Health Service were detailed to make a survey of the extent of th migration and to report the results. This survey covered the health resort sections of North and South Carolina, Texas, Arizona, Nev Mexico, California, and Colorado. Different officers took part i the survey and their reports have been published.[1] Considering th difficulty of getting data on which to base conclusions, the servic has had rather satisfactory results in this matter. It is interestin to note how similar the reports of these officers are, including thei conclusions and recommendations.

As you are probably aware, there have been a number of sugges tions to meet the question. One was the building of a series of Fed eral hospitals which would be open for the admission of tuberculou persons traveling in interstate traffic. It was considered by a Hous committee, but not reported on. In the recent past another bill ha been introduced which is of a somewhat different character. It pro vides that the Federal Government shall grant subvention to hos pitals where the States will pay a like sum of money after an inspec tion of the hospital by the Public Health Service. The bill als authorizes the collection of data regarding the cure of tuberculosi and hospital construction and maintenance. The bill has been re ported to Congress. From a governmental standpoint it is a radica departure from other methods for the taking care of sick persons.

There is no doubt that the subject is an interesting one, but ther are two sides to it. I have been told that the States which woul probably benefit most and receive the largest subvention would no be California and others whose climate is reputed to be a cure fo tuberculosis, but New York and other States in which are locate larger cities.

[1] Reprints No. 265, 266, 269, and 283 from the Public Health Reports.

I should like Dr. Beatty to open discussion on this subject.

Dr. BEATTY. This is a question in which Utah is vitally interested. Many indigent victims of tuberculosis arrive here and become public charges. They are evidently attracted by our favorable climate and believe that all that is necessary is to reach here; but they are soon disillusioned, as there is no provision in the State for their care. They are not only a burden on the community, but a menace to the public health. The practice on the part of the authorities is to pay their fare out of the State.

The trend of this migration is ever westward, and from the record of California, I would conclude that that State is the final destination. In some localities of California the death rate is as high as 400 per hundred thousand, and in the State at large is 190. Between 10,000 and 15,000 cases annually migrate to the Southwestern States.

None of the methods yet proposed appeal to me as a proper solution of the problem, and I think it would be very desirable if this conference could evolve a rational plan. For one thing, I am convinced that a campaign of education in the East would be an effective measure. People should be made to understand that the question of climate is not important; that good food and proper care are the essentials to a cure; that institutional treatment is equally efficient, whether in the East or in the West. I believe further that an interstate agreement should be effected, if practicable, whereby migratory cases might be returned at the expense of the State where they have a legal residence. The question is one involving important humanitarian, economic, and public-health considerations and demands prompt attention.

Dr. GUNDRUM. There is no doubt that Dr. Beatty is right in saying that the trend of the migration is westward and that it keeps on westward until it gets to California. He is right, too, about our mortality from tuberculosis. We have been much interested in this question. The secretary of our board has been in Washington for the last three or four weeks preparing the way for a Federal subsidy to hospitals taking care of tuberculous persons who have resided in the State for less than a year.

Dr. WOODWARD. Gentlemen, the problem seems to me to be a much larger problem than tuberculosis. I fail to see why we should call on the Federal Government to aid the tuberculous stranger who is stranded within our gates any more than the person stricken with syphilis or rheumatism or any other disease; in fact, I fail to see on just what principle the Government should call on the taxpayer of the District of Columbia to contribute to the support of a citizen who happens to be stranded in California.

It seems to be the impression that the resources of the Federal Government are inexhaustible. If we ask for an appropriation

whereby the Federal Government will go into the States and hand
tuberculous cases, why not do the same in the case of the insane
I am impressed with the idea that the States ought to bear their ow
burden. I admit that some arrangement might be made for the r
turn of some of these patients to the States from which they com
That, however, I fear will have to be a matter of adjustment betwe
the States, and I doubt very much whether it would be practical
provide any legislation whereby a man could be taken by force fro
California and returned to Montana against the will of Montana.

If a poor man who happens to land in California and becom
stranded because he has tuberculosis is to be made a Federal charg
why shouldn't the rich man who comes to California because he h
tuberculosis and carries his wealth and ability into that State
made a subject for which California should pay the Federal Gover
ment a fair compensation? Certainly, it is a poor rule that does n
work both ways.

Dr. SIPPY. Along in 1849 and the fifties a great many peop
migrated to the Southwest. They traveled overland, spending t
whole time in the open air, and by the time they reached the sho
of the Pacific they recovered and attributed it to the climate of t
West. California and the Western States did not lose sight of th
opportunities and advertised the curative benefits of the climate.
wonder whether the Southwest is not responsible for what it is n
suffering from these indigent cases?

At the same time I do not believe with Dr. Woodward that t
appropriation from the Federal Government is going to accompli
an influx of undesirable immigrants. That is a matter that is goi
to rest with the Eastern States in their opportunity of showing t
consumptive that it is a life in the open air and not the climate th
cures him.

It has been brought out that 20,000 tuberculosis patients go
the West from the East every year. Of this 20,000, 12,000 die
first year and the remaining 8,000 are practically paupers or una
to care for themselves. It is, to my mind, a big problem for
Southwest.

Dr. WYMAN. Whether this bill is desirable from the point of vi
of the Government or not I do not know, but I think it would h
Wyoming out of a dilemma. We have not exploited Wyoming
a health resort, consequently we have not had as much of the mig
tion of tuberculous cases as a great many other States. Thirty-fo
years ago I landed in Cheyenne, supposed to be a tuberculous patie
I am still living and I am not a pauper, so I must attribute it to
climate of Wyoming.

The fact with us is that we do not know what to do with th
tuberculous patients. They are not on a par with the patients

Woodward mentioned, because we do take care of the others. We have no hospital in Wyoming that can take care of tuberculous cases. This matter was brought to my attention only a short time ago. A patient that was partly indigent was taken up by one of our boards, but, as they could not find a place in Wyoming to take care of him, they sent him to Colorado, which was willing to take him. That is about all we can do with them—ship them on to another State, as Dr. Beatty has suggested. It is not a solution, but we do it because other States do. We have a great need in Wyoming for an institution where these people can be taken care of, and if this Federal bill will help us to solve the problem I am heartily in favor of it.

Dr. SIPPY. May I suggest that if the Federal Government should provide means for taking care of these pauper patients, it might encourage migration to the Southwest? A patient who had no means of treatment at home might migrate to get treatment at the hands of the Government.

The CHAIRMAN. If there is no further discussion, we will adjourn until 10 o'clock to-morrow morning.

SESSION OF FEBRUARY 3.

MORNING.

RAILROAD SANITATION.

The CHAIRMAN. From time to time the subject of railroad sanitation has been discussed in the annual conferences of State and Territorial health officers with the Public Health Service, and also in the conferences of the State and provincial boards of health. The matter is of perennial interest, and as a result of these conferences in years gone by, the several States have become active in the matter. They have issued regulations, giving rise to more or less lack of uniformity. The object in bringing up this subject in these conferences therefore is the securing of uniformity.

It was recognized that any recommendations emanating from this body would have to be in the nature of minimum requirements and that two objects were to be obtained: The adequate protection of the public health and the accomplishment of this purpose with a minimum of interference with interstate commerce. As you know, all interstate sanitary and public-health work is done in the interest of interstate commerce and in accordance with the interstate-commerce clause of the Constitution.

The last annual conference discussed railroad sanitation and made a final draft of regulations which were to be issued by the Secretary of the Treasury under the quarantine act of February 15, 1893.

These regulations have been in course of preparation during a peri of two or three years. Copies were furnished to all of the St boards, and the amendments and revisions suggested in the conf ence were taken into account. A final draft was completed by t sanitary board of the Public Health Service and submitted abo six weeks ago to the Secretary of the Treasury and issued by hi thus being made official. These regulations are now in press, but have a copy and I think that our time will be best utilized by havi them read. There are 36, which gather together all regulatio issued from time to time by the department since 1894, with su revisions as appeared necessary. I may say for the information those in the conference that these provisions and regulations are force now, and have been in the main for some years, in the tran portation of Government patients to the Government sanitarium the Southwest. I am going to ask Dr. Bascom, a member of t State Board of Health of Utah, to read the regulations. (Dr. Basco did so.[1])

There are a number of these regulations which would never operative except during the occurrence of epidemics; for instan the control of mosquitoes and the regulations relating to the mov ment of trains and vessels from territory infected and infectable wi yellow fever. We have had no case of yellow fever in the Unit States since 1905. At the last epidemic, in New Orleans, tho regulations were in effect practically in their present form, and their use and by Federal oversight, in cooperation with the States, was possible to maintain freight operations and the transportati of passengers in and out of infected territory. Some supervisi must be had during epidemics of yellow fever, because in the pa there has been no disease which has caused such apprehension a unreasonable action on the part of outside communities.

The regulations for plague are also operative only during t prevalence of epidemics, and they have been in practical use in Ne Orleans for some time. They have been effective in maintaining t traffic out of that city both by trains and by vessels.

There are some phases of the regulations that are new, and first sight it might appear as though they were impracticable of e forcement. That remains to be seen. From a public health a scientific point of view, we must take cognizance of interstate sa tary matters, and we must do it uniformly. The object, therefo of those regulations, which in one or two instances may seem to in advance of their time, is to encourage reasonable control and guard against dissimilar action by the States.

[1] An edition of the Interstate Quarantine Regulations, giving them in the form read Dr. Bascom, was published by the Public Health Service in April, 1916, as Miscellane Publication No. 1.

As you will observe, many of the regulations relate to sleeping and dining cars. Some measures suggested in them have been in practical effect on Pullman and other cars for a number of years. We have had the cordial support of the Pullman Co., and there has been a willingness on its part to meet reasonable requirements. Indeed, it is the desire of that company, as I understand it, to secure uniformity in the several States. In past conferences we have had the advantage of having the advice of the sanitary representative of the Pullman Co.; and as he is here this morning I should like to call on him for such remarks as he may deem advisable and then open the subject for general discussion.

Dr. T. R. CROWDER. It seems to me that the object of these rules is a twofold one: First, to prevent the contraction of communicable diseases in railway cars, and second, to insure clean and decent accommodations for passengers. Now, in asking ourselves whether the rules as here read are designed to accomplish these objects, I think we must answer, in the main, yes. Some of them are difficult to comply with. Some of them put the burden of compliance largely on the passenger. That is almost necessary in connection with the transportation of infectious diseases, because the carrier can scarcely be held responsible for the results of conditions of which he is not cognizant. He can only refuse to transport a passenger when he knows that he has a disease coming under the ban of these regulations.

As Dr. Kerr stated, we have been complying with the most of these regulations during a number of years. One of the main points in getting good work out of other parties is to make them understand, in a measure, the reason why you want them to comply with certain rules. A year or so ago, therefore, I drew up a little circular which was presented to our car operatives in which I attempted to tell them why we wanted them to do certain things. I explained bacteria and how they are transferred from person to person or from things to persons, and then I followed this with an explanation of the rules with which they were expected to comply. I will state in brief what these rules are:

Sweeping.—Sweeping of the interior of the car in transit with an ordinary broom is prohibited. This rule applies to the smoking room as well as to the body of the car. Many cars are now equipped with vacuum cleaners, which draw the dust from the carpets and upholstery, but do not distribute it through the car. These cleaners must invariably be used in removing dirt, crumbs, etc., from inside the cars. On such cars as are not provided with vacuum cleaners a whisk broom and dustpan should be used when necessary.

Mopping.—Uncarpeted floors may be wiped with a wet sponge, cloth, or mop. Brooms or sponges that are used for cleaning must never be moistened in the water of the toilet hopper. This water always contains many germs from the remains of discharges, even though nothing is visible, and mopping with it

only spreads these germs in a thin layer on the floor to dry and be rubbed int dust. For the same reason cloths or sponges used for cleaning the cuspidor should not be used on the floor, and sponges that are used for wiping the floo must not be used to wipe out the washbasin.

Dusting.—Dry dusting of the interior of the car is prohibited. The du swept from clothing not only is a nuisance to the people sitting near, but ma contain disease germs. All brushing should be done only in places where th dust can not bother passengers; for instance, in the passageway or vestibule.

Ice.—Ice that is put into the drinking water must be handled only wi tongs. The hands are often soiled and have disease germs on them when the do not show it; and these germs may be carried into the drinking water wi ice that is picked up by the bare hand. Never use the bare hand on ice th goes into the water. If the tongs are misplaced or lost, use a clean towel ov the hands. Buckets that are used for ice must not be used for any oth purpose. They must be kept clean when not in use.

Concerning the last rule let me say that during the last two three years we have been building new cars and reconstructing a our old cars in such a manner that separate ice and water com partments are put in all water coolers. The ice does not go int the water, therefore the handling of ice or the using of contaminate ice is of but little or no moment in connection with the possibility contracting disease.

There is also a rule prohibiting the use of the common drinkin cup, and a few words are added explaining the reason why this done.

The next rule concerns the use of screens, which must be kept dow when windows are open. We tell them what screens are for.

Then, we give instruction concerning ventilation and heating. I this section I attempt to bring out the fact that, while it is necessar to secure good ventilation, many of the complaints of bad ventilatio result from the overheating of the car, not from an inadequate supp of fresh air. That this is a fact has been quite clearly demonstrate by a long series of tests which we have carried out within the la few years.

The next rule tells of the use of the disinfectant solution, wit which our cars are always provided. I explain what it does, wh it does it, and under what conditions it is to be used.

The next rule is concerning the reporting of the carrying of sic persons. If sick persons are carried, we do not ask for a diagnosi but we want to know about it in order to have the car fumigate immediately on its arrival at the terminal.

We have found through a series of experiments in the last fe years that by the vacuum-cleaning process we can do much bett work, and that we can do it in a shorter period of time. It was in possible to carry out that plan of procedure until we had, throug experimental work, developed a machine adapted to the purpos

of car cleaning in the yards. Such a machine now has been relatively perfected and is doing excellent work over most of the country.

The CHAIRMAN. We are fortunate this morning in having the representatives of some of the railroads present. I think it is always fortunate for health officials and representatives of common carriers to get together. Mr. Elliott, have you anything you would care to say to us?

Mr. ELLIOTT (representative of "The Salt Lake Route"). Mr. Chairman, I have not had an opportunity to make any special study of sanitary conditions. I do know that we have the same rules as our neighbors for cleaning cars, analyzing ice and water, and that our agents and trainmasters and supervisors, etc., are supposed to supervise this work, as in the case of their other duties. I am traveling over the railroad all the time, and I expect to look into the matter at stations and in cars and do all the supervision possible. Perhaps, when I know more about the subject, I will follow Dr. Crowder's suggestion and explain to our agents and other employees just why these regulations are necessary. I can say for our company that we are very anxious to cooperate with the State, municipal, and Federal authorities in doing all that we can to conserve the public health.

Mr. Chairman, I would like to ask on what date these regulations will become effective and whether they are subject to amendment.

The CHAIRMAN. The date will be contained in a circular letter soon to be issued by the Public Health Service. The regulations are subject to amendment at any time, but that is generally taken up at the annual conferences of this body.

Dr. SIPPY. I think it might be of interest to some of the Western States, and perhaps to a great many others, to know the means of control of water supplies which has recently been inaugurated in Kansas.

Under a law enacted in 1909, the State board of health has absolute control over all streams of municipal water supply in the State. No city may furnish water without its methods and plant having been approved by the board. Furthermore, no city may dispose of its sewage into any stream until the means of disposal and the working of the plants have been approved by the board. When this law was passed many cities had already installed sewage plants, and they were given temporary permits of two years, which might be renewed at the discretion of the board.

At the last session of the legislature another law was enacted (ch. 327, Sess. Laws, 1915) which is rather unique in water control. It provides that before any water can be furnished in the State of Kansas for the consumption of any of its citizens it must be approved by the water and State laboratories of the State university, which

were already under the supervision of the secretary of the Sta board of health, and by this law were officially designated as th State Water and Sewage laboratories. A license system for th examination and certification of water supplies is provided, the fe being fixed by the board of health and approved by the board administration. Consequently the city must pay a fee for the exam nation and certification of its water supply.

Ground-water supplies must be examined twice a year, both b actual inspection of methods of handling and by a bacteriologic examination. Surface-water supplies, or impounded supplies, mu furnish weekly samples and are inspected twice yearly. The inspe tion is carried on by our sanitary engineers. The fees are graduat on the basis of the population of the cities, being from $30 to $250.

In addition, any person selling bottled waters, spring waters, anything of that sort must procure a license from the board of healt first furnishing samples and having his methods of bottling approve He pays a fee of $25. Further, all manufacturers and dispensers ice are subject to the same inspection and analysis, and must pay license fee of $25. In the same way the railroads must pay a licen fee for inspection twice a year, samples of water being furnished fro each division point where they take on water. They pay $15 for ea division point. Of course, all the preceding applies only to intrasta transportation.

In the regulations which have just been read you will note th railroads may obtain certification of their water supplies from m nicipal health officers. While the water may be pure at the poi where it leaves the city mains, however, yet it may be contaminat in the method of introducing it into the coaches. Certification by t municipal health officer is therefore hardly sufficient. That seems me to be a little error in the regulations. Some of our railroads ha demurred at paying $15 for a division point, stating that they shou not be compelled to pay this fee when taking water from a city supp that had been certified; but many municipal health authorities, the other hand, protest that the analysis which has been given th water supply by the board of health should not apply to water tak on trains. We found in the case of one railroad that the same ho which was used to fill water compartments in the coaches was us for washing out cuspidors.

I thought that perhaps the preceding explanation of our law mig be of some value to those of you who are looking forward to securi legislation. The license fees go to the support of the State Wat and Sewage laboratories and make them self-supporting. Th amount to about $7,000 a year.

The benefits of this law are quite apparent and far-reaching. Fir to the public it insures a very much greater protection in the puri

of its supply by constant periodical inspection and laboratory examination. Second, to municipalities this constant supervision insures the protection of its citizens and enables them to maintain laboratory supervision at a very much less cost than they could maintain individual laboratories of their own. Third, to the conscientious bottler of spring and artificial waters, who is provided with proper sanitary equipment for sterilization of containers and who takes precautions to furnish a pure supply, it gives protection from unfair competition with the ill-equipped, unscrupulous, ignorant, and careless dealer. Fourth, to the railroads it insures laboratory services at a much less cost than if they maintained their own service and inspection. The cost of the service and inspection is more than returned to them in railway fares paid by our inspectors in traveling about the States in supervision of water supplies. Furthermore, the railroads are enabled to say to the traveling public that they are using every method to insure pure water and are even having their methods and their supplies rechecked by an unbiased and unprejudiced authority. Fifth, to our laboratories the law gives opportunity for a broad and invaluable experience in the handling of water at all points and by all methods, and a much broader experience than could possibly be gained by any individual railroad or municipal laboratory. Finally, the opinion of the laboratory, which is unaffected by local prejudice or political influence, is of greater value to the public and is more generally accepted by them as being authentic than the opinion of local laboratories.

Dr. BEATTY. Referring to the regulations, I wish to make the point that it is desirable that the Western States adopt them in order that there may be uniformity of requirements. Both the State authorities and the railroads in this part of the country have long recognized the need of this. The Utah Board of Health has the power to adopt sanitary regulations binding on railroads, but we have deferred taking action until we had met with the other Western State officials and agreed on a uniform system.

The CHAIRMAN. Under the provisions of the law of February 15, 1893, the State health officers may enforce these regulations as their own for the control of the spread of diseases in interstate traffic, and I think the same regulations, where applicable, should be adopted by the States for intrastate traffic, in order that we may secure uniformity. Later such amendments as seem necessary could be made. It seems to me that this is a method of approach to an end which has been accomplished in England and in Germany. Through their railroad by-laws they issue these regulations, and all the communities may adopt them if they wish to; in Germany the uniform regulations are accepted by the State and municipalities and enforced by them.

Dr. WOODWARD. I move that it is the sense of this conference tha the Surgeon General of the Public Health Service appoint a com mittee to study the regulations that have been presented here to-da and the regulations now in force in the several States for the contro of intrastate commerce, with a view to submitting recommendation at the next annual conference as to amendments or revisions tha may be necessary. The understanding is that a code may be estab lished for the State as well as for interstate commerce.

The great trouble with this conference is the hurried way in whic work has to be done, the absence of a suitable opportunity for study and if my motion is adopted, I hope it may be made clear to th Surgeon General and to any of the States that may have represent tion on any such committee, that work of this kind can not be don by getting the committee together on the day before the conferenc and can not be done by correspondence, that if the work is wort doing at all it is worth doing well, and that the committee shou hold at least one session, probably two or three sessions, each lastin for several days.

(Dr. Woodward's motion was seconded and carried.)

The CHAIRMAN. If you will permit me, I see no reason why motion should not be acted on at this conference recommending t the States the adoption, pending the report of the committee to b appointed under Dr. Woodward's motion, of such of these regul tions as will be adaptable to the States' needs.

Dr. WOODWARD. I want to say that, as a practical proposition, think that would be unfortunate. I believe that the adoption o piecemeal legislation is one of the curses of our legislative systen and where we have been operating for years either under certai regulations or without any it would seem to be far wiser to remai under the present arrangement until we can secure something pe manent. It may be that some of these regulations will be change by many of the railroads and State boards and that the travelin public will be confused as a result. I don't believe it would be wi to tinker with such legislation. Let the whole job be done at once.

Dr. DOREMUS. As has been stated by Dr. Beatty, the State Boar of Health of Utah has authority to formulate rules which in sub stance have the effect of law. So far the board has refrained fro formulating such rules relating to railroads for the reason that the was no similar action by adjoining States. We delayed for the sak of securing uniformity.

If some men of experience have the understanding that the reg lations offered by the Public Health Service are applicable to th conditions here in the West, then the board of Utah could adop them, if at this time there could be any assurance that other Stat

would adopt a similar course. If not, then necessarily we must defer action until such uniformity can be realized.

The CHAIRMAN. It will only be a matter of 90 days or so until the next conference convenes, and the States can very well take the intervening time to study these regulations. If they are not full enough or if they need changing, by all means let us determine in conference what is necessary. In that way we will establish in the end uniform regulations and accomplish the purpose that we have all been striving for.

Dr. BEATTY. Mr. Chairman, I move that this conference recommend to the Western States the adoption, in so far as applicable, of the interstate regulations as they may be amended. I offer this because for years we have endeavored to secure a conference of Western States on this subject. If we wait for another conference, the question might be deferred indefinitely.

Dr. BASCOM. As I understand it, the idea is that this committee on the regulations should be empowered to act for the Western States in so far as they are represented here. Of course, we can not pledge the States which are not represented here, but we can pledge our support in order that the question may be settled without further action from separate States.

Dr. TUTTLE. We can not pledge ourselves that our State shall adopt these regulations as amended, because the majority of each board of health is not present. All that we can do as representatives is to say that we will do our best to get our board to adopt them. I do not believe that any resolutions on the part of this convention would bind a single State. A recommendation is as far as we can go.

Mr. ELLIOTT. I wonder if the doctors really understand to what a large extent our business within any State is governed by the regulations for interstate commerce. For instance, in the absence of any regulations in Utah or Nevada to the contrary, after we received the regulations that were promulgated by the Surgeon General we would immediately put them into effect on all our business, because cars in local service to-day between here and Bingham to-morrow may go to Los Angeles. Therefore, if we are to have any different regulations in the States from the interstate regulations it would simply result in the confusion this body is endeavoring to overcome.

The CHAIRMAN. It is desirable that we should adopt uniform regulations. In the event that these regulations do not meet the needs they should be amended, and it will be understood that an action by this conference is in effect a recommendation to the Secretary of the Treasury as much as to the health boards of the different States. In other words, this is in the nature of an ad referendum convention. Its action is not binding, but suggested rules may be made binding on subsequent action of the States or the Treasury

Department. With that understanding, if there is no objection, will consider the motion of Dr. Beatty as adopted.

NEW BUSINESS.

Dr. BEATTY. Mr. Chairman, while the gentlemen from surrou ing States are here, I would like to ask if there has been noted them a disease which has prevailed in certain parts of Utah fo number of years? The disease is evidently transmitted by the b of the so-called deer fly and occurs in June and July exclusively two localities in the State. Many persons are attacked annua principally men working in the fields. There is invariably a hist of the bite followed in a few hours by a chill and high temperatu The location of the bite is usually the neck or in front of the e The surrounding tissues quickly become very much indurated, a in the course of two or three days begin to slough, leaving an ul of characteristic appearance that is very slow in healing, taking t weeks at least. The neighboring lymphatics become involved a usually suppurate. The constitutional symptoms are always sev and recovery is slow. A few fatal cases have been reported. T pathology is unknown and offers a problem which the Public Hea Service is assisting us to solve.

The CHAIRMAN. Does any delegate from the Western States w to discuss this subject? It is undoubtedly an interesting one a one that ought to be looked into carefully. If there should hap to be records of cases resulting from the bites of such insects, I sure the department would be glad to receive communications fr the State or local health officers regarding the matter.

REPORT OF RESOLUTIONS COMMITTEE.

If there is no further discussion, I will call on Dr. Woodward the submission of the resolutions which have been acted on by committee.

Dr. WOODWARD. I will ask Dr. Gundrum, who kindly acted secretary of the committee, to present them.

(Dr. Gundrum read the resolutions, as given herewith.)

RESOLUTION I.

Whereas rabies is now epidemic in several Western States; and

Whereas the lives of the inhabitants of these States, especially those livi rural districts, are thereby endangered; and

Whereas large financial loss due to death of valuable stock from this di is threatened and is occurring in increasing proportion; and

Whereas in the majority of these States there is no present legislation quately supplying the respective State boards of health and other agencies with suitable authority in the establishment of quarantine are funds to carry on a necessary campaign against this disease; and

Whereas the police authority needs must come from the State governments, except so far as relates to lands under exclusive Federal control: Therefore be it

Resolved, That this conference strongly urges the early adoption by the various States of legislation which will provide the State boards of health and other State agencies with proper authority to establish quarantine areas against rabies and with adequate funds for the campaign against this disease.

(2) That the authorities of the several States request cooperation from the appropriate Federal departments in the establishment of a systematic plan for the eradication of rabies, including the calling of conferences from time to time to promote the efficiency of the work.

(3) This conference recommends the immediate adoption of the following provisional plan for the limitation and eradication of rabies:

1. That the destruction of wild animals devolve on the proper State authorities and commercial interests within the State acting in cooperation with the United States Department of Agriculture.

2. That the prevention of rabies among humans, including the control of the diseases among domestic animals and measures for prophylactic treatment, devolve upon the State health agencies cooperating with the United States Public Health Service.

3. That the United States Public Health Service be requested to detail an officer or officers to cooperate with State health agencies in stimulating and coordinating local activities with respect to the limitation and suppression of this disease.

(Resolution adopted unanimously without amendment or discussion.)

RESOLUTION II.

Resolved, That it is the sense of this conference that the most important step in the campaign against Rocky Mountain spotted fever is the early determination of the areas of infection within the different States; and

Since Rocky Mountain spotted fever is peculiarly a disease of the most remote localities, it is recommended that the State health officers within their respective States take such steps as they may deem necessary for the collection of more complete morbidity reports from these districts and that they, in cooperation with the Public Health Service, conduct a campaign of instruction by circular and otherwise, within these districts; that the cooperation of the Department of Agriculture[1] be secured in the efforts to reduce to tick infestations by small animal destruction.

(Adopted unanimously.)

RESOLUTION III.

Whereas a report to this conference has been made concerning the efficiency of mange inoculation in the eradication of coyotes and wolves: Therefore, be it

Resolved, That the United States Department of Agriculture and the various State agencies be requested to investigate the practicability and efficiency of scabies or mange inoculation of predatory animals for their eradication as practiced in the State of Montana.

(Adopted unanimously without discussion or amendment.)

[1] A slight amendment was made in this resolution, the draft submitted by the resolutions committee reading "Forest Service and Biological Survey" instead of "Department of Agriculture."

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 81
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STUDIES IN VOCATIONAL DISEASES

THE EFFECT OF GAS-HEATED APPLIANCES UPON THE AIR OF WORKSHOPS

By

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PREPARED BY DIRECTION OF THE SURGEON GENERAL

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EFFECT OF GAS-HEATED APPLIANCES UPON THE AIR OF WORKSHOPS.

By CHARLES WEISMAN, *Sanitary Chemist*,

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On page 15 of Public Health Bulletin No. 71,[1] reporting a general investigation of the health of garment workers in New York City, made on request of the Joint Board of Sanitary Control of the Cloak, Suit and Skirt, and Dress and Shirt Waist Industries of that city, it was stated that a certain part of the investigation, relating to the effect of gas-heated appliances on the air of workshops, was still in progress. The present bulletin sets forth the results of this study. The work was done by Sanitary Chemist Charles Weisman, of the Public Health Service, under the general direction of Surg. J. W. Schereschewsky, in charge of studies of industrial hygiene for the service.

Scope of the Investigation.—The investigation included:

(1) Analyses of air samples taken in shops of the garment industry with reference to the amount of carbon monoxide gas present, and studies of the condition of gas-heated appliances.

(2) Laboratory examinations of the gaseous combustion products of various kinds of gas-heated pressing irons.

(3) Tests of the permeability to gas of the walls of various kinds of flexible gas tubing, and of the security against leakage of gas connections.

(4) The hygienic significance of the presence of small amounts of carbon monoxide in the air of confined inhabited places.

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[1] Studies in Vocational Diseases, (1) The Health of Garment Workers, by J. W. Schereschewsky; (2) The Hygienic Conditions of Illumination in Workshops of the Women's Garment Industry, by J. W. Schereschewsky and D. H. Tuck.

and Dress and Waist Industries, for his cooperation and assistance to the Consolidated Gas Co., of New York City, and their engineers Mr. O. H. Fogg and Mr. J. M. Haralson, for the loan of pieces o apparatus and their cooperation in many other ways; to the Ameri can Meter Co. and the Connolly Iron Sponge & Governor Co., fo the loan of various appliances; and to the following manufacturer of gas irons for the loan of sample gas irons: American Pressin Iron Co., William M. Crane Co., Ensor & Co., New York Pressin Appliance Co., Rosenbaum Manufacturing Co., Sunshine-Jasper Co and Stockwell & Co.

I. EXAMINATION OF AIR AND GAS-HEATED APPLIANCES IN WORKSHOPS.

METHODS FOR THE DETERMINATION OF CARBON MONOXIDE.

Speaking generally, methods for determining the presence of carbon monoxide may be divided into two groups, the physiological and the chemical. The physiological method is based on the fact that carbon monoxide is absorbed by the blood, forming a stable compound (carbon monoxyhemoglobin[1]).

The chemical methods may be classified as absorption and oxidation methods. The former depends on the absorption of the carbon monoxide by a solution of cuprous chloride in hydrochloric acid or ammonia and on the measurement of the resulting contraction in volume of the gas mixture. This method is suitable only for the determination of fairly large amounts of carbon monoxide. Oxidation methods depend upon the oxidation of carbon monoxide to carbon dioxide, the amount of carbon monoxide present being determined either directly by measuring the carbon dioxide produced, or indirectly by the amount of the oxidizing agent which has been reduced. Among the various substances which have been used as oxidizing agents are copper oxide, mercuric oxide, palladious chloride, and iodine pentoxide.[2] In the case of iodine pentoxide, carbon monoxide may be estimated from either the amount of iodine liberated or the amount of carbon dioxide formed, use being made of Ditte's (11) observation in 1870 that iodine pentoxide, when heated to between 150 and 200° C., is decomposed by carbon monoxide as follows:

$$I_2O_5+5CO=I_2+5CO_2.$$

The oxidation method, with the use of iodine pentoxide, was selected for testing the air of workshops.

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[1] Although both this compound and oxyhemoglobin give two absorption bands in the spectrum, carbon monoxyhemoglobin is not reduced by such reagents as ferrous sulphate or ammonium sulphide, while oxyhemoglobin is reduced.

[2] For a full review of the development of the iodine pentoxide method for carbon-monoxide determination, the reader is referred to Appendix A.

DESCRIPTION OF METHODS OF SAMPLING AND ANALYSIS.

Two and one-half liter flasks were used for taking air samples. The flask was filled with water in the shop where the sample was to be taken, then inverted, the water being allowed to flow out. A rubber stopper greased with vaseline was used to seal the bottle after the sample had been taken. As a rule, two air samples were secured in each shop, one about 2 inches from the lighted gas iron, the other in the same room, near a window, as far away as possible from the source of air contamination.

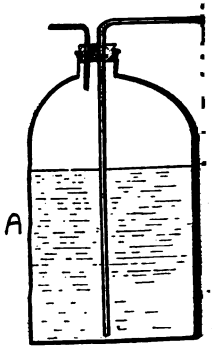
The apparatus for analysis of the sample consisted of the following parts:[1]

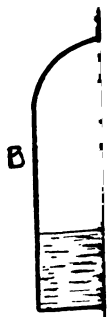
1. A train of absorption bulbs (C) containing concentrated sulphuric acid to dry the air and to remove a portion of any unsaturated hydrocarbons present.
2. A train of bulbs (D) containing fuming sulphuric acid to remove the remainder of such unsaturated hydrocarbons.
3. A train of bulbs (E) containing potassium hydroxide solution (25 per cent) to remove acid vapors from the fuming sulphuric acid and carbon dioxide from the gas sample.
4. A train of bulbs (F) containing concentrated sulphuric acid to remove moisture.
5. A U tube (G) containing small pieces of caustic potash to remove any vapors from the sulphuric acid.
6. A U tube (H) fused to (G) and containing iodine pentoxide immersed in a bath of cottonseed oil heated to 150° C.
7. A train of bulbs (I) containing 5 c. c. of 10 per cent solution of potassium iodide, to which was added 0.5 c. c. of a 0.5 per cent solution of soluble starch, to absorb the liberated iodine.

The bottle containing the air sample was placed on the floor, the stopper removed, and a stopper perforated by glass tubes connected with the apparatus immediately inserted. The air sample was driven through the apparatus by allowing the water from bottle A to flow into air sample bottle B. The flow of water was started by gently blowing into the side tube at the upper part of bottle A. The rate of flow was regulated by the pinch cock at *r*, and was such as to require about 1¾ hours to displace the air in a 2,500 c. c. bottle. After the gas in the air sample bottle had been displaced by water, the stopcock at S was closed, the bulb I, containing the liberated iodine, was disconnected, and after the entire contents of the bulb had been blown into a small beaker, the liquid was titrated with N/1000 sodium thiosulphate until the disappearance of the iodine blue-starch color. Each c. c. of N/1000 sodium thiosulphate was equivalent to 1 c. c. of carbon monoxide at 0° and 760 mm. pressure.

As iodine pentoxide is decomposed by water, organic matter, and high heat, great care had to be exercised in the use of the reagent,

[1] See fig. 1.





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(1) to get a pure reagent kept in glass-stoppered bottles, and (2) to keep out organic matter or other impurities in filling the U tubes. After being powdered, the iodine pentoxide was put into the U tube with alternate layers of glass wool, each about three-eighths of an inch in depth, in order to prevent possible caking and clogging of the tube.[1] A safeguard used to prevent the introduction of organic matter from the room or of vapors from the oil bath was to fuse the U tube containing the iodine pentoxide to the U tube containing the pieces of caustic potash.[2]

Before using the iodine pentoxide for an analysis it was heated to 200° C. and purified air passed through the apparatus until no "free iodine" was given off. This often required a day, sometimes much longer. At the termination of an analysis either purified air was passed through the apparatus until the residual gas had been swept through and any free iodine carried over from the iodine pentoxide U tube into the absorption bulb, or, if laboratory air was used, a blank analysis was made on an amount of air equivalent to that used to clear the apparatus, the CO value for the blank being deducted from the total. Usually about 1 liter of air was sufficient to clear the apparatus.

RESULTS OF AIR TESTS IN SHOPS.[3]

CARBON-MONOXIDE RESULTS.

In the course of the present investigation air samples were taken from 244 shops. Of these, 29, or 11.8 per cent, were found to

[1] The capacity of the U tube was about 9 grams of iodine pentoxide.

[2] In this process the hot flame from the blast lamp must be kept as far away as possible from the part of the tube containing the iodine pentoxide.

[3] In an investigation of the ventilation of cloak and suit shops for the Joint Board of Sanitary Control of New York City in 1911, Dr. C. T. Graham-Rogers (51), chief medical factory inspector of the New York State Department of Labor, reported the results of analyses of air samples for carbon monoxide. He used the palladious chloride method (52), air samples being taken near the breathing level of the pressers. From an analysis of his work the following table was constructed:

Graham-Rogers' results of carbon monoxide analyses in shops of the garment industry.

Number of shops.	Amount of carbon monoxide—	
	In 10,000 parts of air.	In 1,000,000 parts of air.
30	Less than ½ part	Less than 50 parts.
9	½ to 1 part	50 to 100 parts.
34	1 to 2 parts	100 to 200 parts.
9	2 parts	200 parts.
1	Over 2 parts	Over 200 parts.
83		

From these figures it is found that 47 per cent of the shops gave a carbon monoxide content of less than 100 parts per million parts of air and that 53 per cent of the shops contained over 100 parts per million parts of air. These results would indicate that pressers may be subject to chronic carbon monoxide poisoning. Records of previous investigations in which iodine pentoxide was used will be found in Appendix A.

have present over 100 parts of carbon monoxide per million part of air.[1] The following table gives the amounts of carbon monoxid present in the air in these 29 shops:

TABLE 1.—*Carbon monoxide present in the air of 29 shops of the women's ga ment trade.*

Number of shops.	Parts of carbon monoxide per million parts of air.
9	100–200
6	200–300
5	300–400
3	400–500
3	500–1,000
3	1,000–1,500
29	Average. 325

From the foregoing table it is seen that the average for these 2 shops was 325 parts of carbon monoxide per million parts of ai These amounts range from 105 parts to 1,431 parts of carbo monoxide.

Of the samples of air taken in these shops near windows a points as far as possible from sources of contamination, the amount of carbon monoxide ranged from 2 to 39.6 parts per million parts o air, or an average carbon monoxide content of 11.8 parts per millio parts of air.

In 55 shops the carbon monoxide ranged from 25 to 100 part per million parts of air, or an average of 47.3 parts. The corre sponding window samples from these shops ranged from 2.2 t 32.3 parts, or an average of 11.4 parts. The average amount o carbon monoxide for the 244 shops from samples taken near pres ing irons was 55.4 parts and from the window samples was 7. parts per million parts of air.

In considering the results of these air tests it should be remem bered that this investigation was carried out during the open-windo season, when almost all of the windows of the shops were kept ope In spite of this fact, it is evident from the foregoing that the air i the vicinity of pressing irons presented a fairly high degree of co tamination with carbon monoxide as compared to the air in the be ventilated part of the shop. The supposition is reasonable that du ing the winter season, with all windows closed, the conditions woul be considerably worse.

MORNING AND AFTERNOON SAMPLES COMPARED.

Of the 244 shops inspected, air samples were taken in the mornin in 165 shops, or in 67.6 per cent of the total number, and in the after

[1] Samples taken near pressing iron.

noon in 79 shops, or in 32.3 per cent of the total. Of the 165 samples taken in the morning, 20 samples, or 12 per cent, gave over 100 parts of carbon monoxide per million parts of air, and 53 samples, or 32 per cent, gave over 25 parts of carbon monoxide per million parts of air. Of the 29 air samples that showed over 100 parts of carbon monoxide per million parts of air, 69 per cent were morning samples and 31 per cent were afternoon samples. Of the 55 air samples that ranged between 25 to 100 parts of carbon monoxide per million parts of air, 33, or 60 per cent, were morning samples and 22, or 40 per cent, were afternoon samples.

As ventilating conditions in the various shops were not uniform, no conclusion could be drawn from a comparison of the carbon-monoxide content in air of shops in the morning to that of the afternoon. Were such conditions uniform, one would expect to find a greater carbon-monoxide content in the afternoon, when products of combustion of the gas irons or of the leakage from gas appliances had an opportunity to accumulate in the air of the shops.

VENTILATION.

No mechanical system of ventilation was used in any of the shops visited, window ventilation being relied upon. Electric fans were provided in 6 per cent of the shops visited, but, of these places, less than half used them. While windows are generally open during the warm weather, with the approach of cold weather it is the general practice to keep them shut. According to statements of the workers in the shops, the windows are kept closed in cold weather chiefly because of inadequate heating provisions and the workers' fear of drafts.

GAS ODOR.

An odor of gas was perceptible in 93 establishments, or 38 per cent of the total number inspected. Out of the 29 shops where the amount of carbon monoxide was found to be over 100 parts per million parts of air, a gas odor was noticeable in 27. Out of 55 shops where the amount of carbon monoxide ranged from 25 to 100 parts per million parts of air, a gas odor was noticeable in 40 cases, or in over 72 per cent of the total.[1]

CONDITION OF GAS-HEATED APPLIANCES.

Gas tubing and gas-tubing connections.—In connection with gas-heated pressing irons, rubber tubing only was used in 188 shops, or

[1] It must be remembered that the shops were inspected when there was every opportunity for the gas odors to diffuse to the outer air through open windows or doors. It should also be remembered that persons working constantly in an ill-smelling atmosphere soon become so accustomed to the odor as not to perceive it, especially when the odor at first is only slightly perceptible and the rate of increase in the amount of the gas escape is small. It is also a well-known fact that persons suffering with nasal catarrh may often be unable to detect a gas odor even if it be strong.

in 77 per cent of the total number inspected, while flexible metal tubing was used exclusively in 23 shops, or in 9 per cent of the total. About 11 per cent of the shops used both rubber and flexible metal tubing. Flexible metal tubing was therefore used in about 20 per cent of the shops. Out of 112 shops where "blower" irons were used, 18 shops, or 16 per cent. used flexible metal tubing in connection with these irons.

Obviously defective rubber tubing was found in 52 shops of the 244 inspected, or in 21.3 per cent of the total. In 36 of these 52 cases defective rubber tubing was the defective condition found; in the rest of the shops, in addition to defective rubber tubing, there were poor gas tubing connections, defective gas irons, and defective flexible metal tubing.

Defective metal tubing was found in 16 shops or in 6.5 per cent of the entire number of shops examined. These 16 shops included 4 shops where flexible metal tubing was the only defective condition found; the other 12 shops had in addition to defective flexible metal tubing, other defective conditions, such as defective rubber tubing, poor gas tubing connections, and defective gas irons.

Defective rubber or flexible metal tubing was found in 66 shops, or in 27 per cent of the total number examined; i. e., over 1 out of every 4 shops inspected was using some kind of defective gas tubing.

Poor gas tubing connections were found in 17 cases, or in about 7 per cent of the total number of shops inspected.

Gas irons.—Out of 244 shops examined, 122, or 50 per cent, used ordinary gas irons only, 102 shops, or 41.8 per cent, used "blower" irons exclusively, i. e., an iron heated by a mixture of gas with air under pressure. Six shops, or 2.4 per cent, used electric irons only, while the rest used miscellaneous irons.

Defective gas irons were found in 21 shops, or 8.6 per cent of the total number. In 10 of these shops the use of defective gas irons was the only defective condition found; in the other shops, in addition to this defect, there were found defective gas tubing and poor gas-tubing connections.

REINSPECTIONS.

That the presence of abnormal amounts of carbon monoxide polluting the air of shops in the garment industry and of the defective sanitary conditions which accompany the discharge of poisonous gas into the air was not limited to the particular day of the inspection and air sampling of the premises was shown by reinspections, which indicated that bad-air conditions which occur on a given day often recur day after day.

Of 10 shops in which the carbon monoxide on the first inspection was over 100 parts per million parts of air, 5 shops on reinspection were also found to have over 100 parts of carbon monoxide. Of these five cases two were found where the carbon monoxide on the reinspection was more than twice as high as on the original inspection.

CONCLUSIONS.

It is evident from the foregoing that the air of workshops in the women's garment trades is often contaminated by carbon monoxide gas. The sources of this contamination are: (*a*) Defective utilization of gas in pressing irons; (*b*) undue permeability of the walls of gas tubes to illuminating gas; (*c*) leakage because of faulty connections; and (*d*) the use of grossly defective tubing. These sources of contamination are considered in Sections II and III of this report.

II. STUDIES OF COMBUSTION PRODUCTS OF GAS-HE PRESSING IRONS.

METHOD OF TESTING COMBUSTION PRODUCTS.

Industrial pressing irons for tailoring purposes may be into two general classes: (1) Gas-heated irons and (2) elec heated irons. The former may be classified as (*a*) those b gas with air at atmospheric pressure and (*b*) those burning g the air under pressure.

GAS IRONS AT ATMOSPHERIC PRESSURE.

The first type of gas irons examined were those burning g air at atmospheric pressure. The gas iron to be tested, a mately 16 pounds in weight, was connected to the gas supply, flames were adjusted so that 6 cubic feet of gas were consun hour. An interval of 20 minutes was allowed for the iron heated, and then a sample of the gaseous combustion produ taken. The tube through which the combustion products we rated was of hard glass, about 6 mm. in diameter, shaped poker, with the short end about 6 cm. in length, and provid a number of small openings (about 1¼ mm. in diameter) shorter side, which terminated in a sealed end. The open the longer side of this aspirating tube was connected by mea piece of rubber tubing to a regular glass sampling tube, wh been filled with water. To take a sample of the gaseous com products, the short end of the aspirating tube was inserted over the opening in the upper part of the gas iron where com products escape into the outer air. The gas-sampling tube, ing water, was held in a vertical position, the stopcocks permitting the water to flow out, and the combustion produc directly over the gas iron ports were drawn into the samplin To displace the air originally present in the aspirating tu rubber connections, and the ends of the sampling tube, the lo

of the sampling tube was connected with an aspirator and more of the combustion products drawn through until all the air originally present in the connections had been swept out. The stopcocks of the sampling tube were then closed, and the gas transferred to a gas burette partially filled with water. The burette was shaken up well so as to saturate the water with the gas. This process was continued until a sufficient amount of water saturated with the gas to be examined had been collected to enable final filling of the sampling tube, the gas burette, and the leveling tube. A sample of the gas combustion products from the sampling tube was now transferred to a measuring burette and the carbon monoxide determined in a Hempel pipette in the usual way by absorption in a fresh ammoniacal solution of cuprous chloride. Before absorbing the carbon monoxide in the cuprous chloride solution the carbon dioxide was removed by treatment with caustic potash, the illuminants were absorbed in fuming sulphuric acid, and the oxygen was absorbed in an alkaline solution of pyrogallic acid.

"BLOWER IRONS."

As the "blower" gas irons have no openings from which it would be convenient to take a sample of the combustion products, the entire gas iron was placed upon a brick inside of a galvanized-iron pail about 11 inches in diameter and 12 inches in height, provided with a suitable cover, and after a suitable interval a sample taken from the air in the pail. The cover of the pail was provided with two holes, one just large enough for the entrance of the rubber tubing connected with the gas iron, the other sufficiently large to permit entrance of the aspirating tube previously described. As used in practice, a blower iron of about 16 pounds in weight consumes from 5½ to 7 cubic feet of gas per hour. For the sake of comparison with the ordinary gas iron, the flame of the blower iron was regulated so as to consume 6 cubic feet of gas per hour. To begin the sampling process, the blower iron, after being lighted and adjusted, was placed inside the pail and covered, one of the holes in the cover being left open to permit the air originally present to be expelled. After an interval of 20 minutes allowed for accumulation of the combustion products of the blower iron, the aspirator tube was inserted in the cover of the pail, connected with the sampling tube, and a sample of the combustion products collected as in the case of an ordinary gas iron.[1]

[1] With the exception of the use of a glass tube gas aspirator instead of an iron tube aspirator, the method of sampling used was that followed by the Consolidated Gas Co. of New York.

RESULTS OF ANAYLSIS.[1]

CUPROUS CHLORIDE METHOD.

The following tables show the results of the analysis of the combustion products of the gas irons investigated:

TABLE 2.—*Analyses of combustion products of ordinary gas-heated pressing irons.*

Iron No.	CO_2.	Illuminants.	O.	CO.	Average CO.	Iron No.	CO_2	Illuminants.	O.	CO.	Average CO.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	11.4	0	7.9	0	.....	5	12	0	3	1.2	.....
	11.7	0	7.8	0	.....		5.4	0	11.4	.4	.....
	7.4	0	9.2	0	.....		7.1	0	8.4	.6	.....
	12	0	4.5	0	.....		5.8	0	10.2	.7	.....
	10.8	0	6.0	0	.....		8.0	0	6.8	.3	0.73
	11.7	0	4.6	0	0	6	11.6	0	2.6	.6	.....
2	13.0	0	3.0	0	.....		7.0	0	9.6	.0	.....
	11.2	0	4.6	0	.....		6.4	0	10.0	.0	.....
	15.8	0	4.0	1.6	.....		6.6	0.15	7.3	1.8	.....
	11.6	0	2.6	.6	.....		5.4	.10	8.3	1.6	.....
	8.2	0	7.8	0	.....		6.8	0	9.6	.8	.80
	10.3	0	4.4	.2	.....	7	8.6	0	6.4	2.0	.....
	11.4	0	7.9	0	.....		7.0	0	7.2	1.8	.....
	6.8	0	9.0	0	.....		8.9	0	7.9	.2	.....
	12.0	0	8.6	.1	.27		6.1	0	11.5	.2	.....
3	6.2	0	10.4	.4	.....		7.4	0	9	.3	.....
	7.8	0	9.2	.6	.....		10.0	0	4	.8	.....
	8.4	0	9	.3	.....		10.4	0	2.6	1.4	.....
	10.2	0	6	.2	.....		9.2	0	2.9	1.1	.97
4	6.0	0	5.0	.5	.....	8	6.4	0	10.8	.7	.....
	7.2	0	8.4	.7	.....		5.4	0	10.6	.6	.....
	7.8	0	9.1	.4	.53		4.2	0	12.4	1.7	1.00
5	11.5	0	1.9	1.2	.....						

[1] Meyer (32), in reporting the results of analyses of the combustion products of blower irons, found from 93 to 110 parts of carbon monoxide per million parts of air, and when the air pressure of the blower irons was diminished found from 540 parts to 710 parts of carbon monoxide per million parts of air. The method of analysis pursued by this investigator is not mentioned. The following table was constructed from data given by him:

Carbon monoxide in the combustion products of pressing irons (according to Meyer).

Experimenter.	Kind of pressing iron.	Source of sample.	Carbon monoxide parts per million parts of air.
Weyl	Charcoal iron	Height of head	1,900–2,500.
Meyer	.....do	Directly above iron	1,350–2,010.
	.....do	Height of head	760–910.
	Iron heated with a specially prepared substance claimed by the manufacturer to be odorless.	Directly above iron	1,240–1,680.
	.....do	Height of head	580–610.
	Iron heated by gasoline and compressed air.	Directly over iron	78.
	Illuminating gas and compressed air	.....do	93–110.
	Illuminating gas and compressed air, but diminished air pressure.	.....do	540–710.
	Iron heated by Dawson gas and compressed air.	.....do	Average, 110.
	Same iron, but using illuminating gas and compressed air.	.....do	Average, 90.

TABLE 3.—*Analyses of combustion products of "blower" or gas and compressed-air pressing irons.*

Iron No.	Carbon dioxide.	Illuminants.	Oxygen.	Carbon monoxide.	Iron No.	Carbon dioxide.	Illuminants.	Oxygen.	Carbon monoxide.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	14.2	0	2.5	0	3	14.0	0	5.2	0
	11.2	0	5.8	0		9.0	0	7.6	0
	11.5	0	6.4	0		9.1	0	8.7	0
	13.0	0	2.4	0		11.4	0	8	0
	11.3	0	5.2	0	4	11.0	0	5.4	0
	14.1	0	4.8	0		9.6	0	5	0
2	12.3	0	2.8	0		12.2	0	4.6	0
	14.4	0	6.2	0		13.1	0	4.9	0
	11.6	0	5.6	0		12.6	0	4.5	0
	10.2	0	6.4	0					
	12.6	0	5.6	0					

In considering the figures in the preceding tables it should be noted that they represent the composition of the undiluted products as they leave the gas iron; these gas products would naturally become greatly diluted as they diffuse further and further into the atmosphere of the room.

From the tables it is seen that the percentages of carbon monoxide given off from atmospheric pressing-gas irons varied from 0 to 2 per cent. It should be borne in mind, however, that the limit of sensitiveness of the method of analysis used was 0.1 per cent. Anything less than 0.1 per cent was therefore reported as 0. The average for 46 tests made on 8 different makes of gas irons was 0.57 per cent of carbon monoxide, and the average for each make of iron ranged from 0 to 1 per cent of carbon monoxide.

In the case of blower irons, analysis of combustion products by the above method showed no carbon monoxide. Twenty tests were made on four different makes of blower irons.[1]

IODINE PENTOXIDE METHOD.

Samples of combustion products from the improved type of atmospheric gas iron described as type number 3 on page 20, and from a blower iron, both of which had given no carbon monoxide with the use of the Hempel apparatus and the cuprous chloride reagent, when examined by the iodine pentoxide method showed the presence of small amounts of carbon monoxide, which, however, were not sufficient to produce symptoms of chronic poisoning. A sample of gaseous combustion products was taken in the usual manner, as if for a determination with the Hempel apparatus. One hundred c. c. of this sample was then diluted with

[1] Here, too, it must be remembered that the limit of sensitiveness with the method used was 0.1 per cent; anything less than this amount being reported as 0.

air to 2,500 c. c., and the carbon monoxide in the mixture was determined by the iodine pentoxide method. The following table shows the results obtained with the improved type of atmospheric iron (see fig. 10) and with the blower iron:

TABLE 4.—*Comparative analyses by cuprous chloride method and by iodine pentoxide method of the combustion products of gas irons.*

	Carbon monoxide by cuprous chloride method.	Carbon monoxide by iodine pentoxide method.
	Per cent.	
Improved type of atmospheric iron (for description see p. 20).	0.0	72 parts of carbon monoxide per million parts of air.
	0.0	90 parts of carbon monoxide per million parts of air.
Blower iron	0.0	64 parts of carbon monoxide per million parts of air.
	0.0	48 parts of carbon monoxide per million parts of air.

GAS-HEATED PRESSING IRONS.

DESCRIPTION.

A brief description of gas-heated pressing irons follows:

Gas irons using air at atmospheric pressure.—The burner of an ordinary gas-heated iron consists of a metal tube or hollow bar supplied with a number of gas ports. It is inclosed in the body of the iron, supported at a fixed distance above the base, and supplied with a mixture of gas and air through a mixing chamber located at the gas intake of the iron. The air-mixing chamber

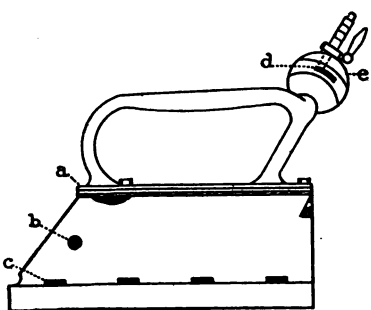

Fig. 2

FIG. 2.—Elevation of atmospheric gas iron, Type I.

Fig. 3

FIG. 3.—Cross-section of base.

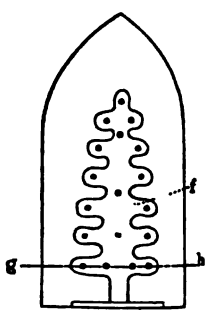

Fig. 4

FIG. 4.—Plan of base.

is connected to the gas supply by means of a gas cock and gas hose. Secondary air is generally supplied to the burner through ports drilled in the side walls near the bottom of the iron. The products of combustion escape to the outer air mainly through openings directly beneath the upper plate, to which the handle is attached, but also through a few ports in the upper part of the wall.

The various gas irons on the market differ somewhat from one another in the construction, shape, size, and arrangement of the various component parts.

Several types of irons used in the garment industr in New York City are here described.

(1) The first and oldest type of gas iron has a base consisting of a hollow metallic casting containing the gas burner. This casting is provided with draft openings (fig. 2, a, b, c) in its side walls near the bottom and with openings for the exit of combustion products near the upper wall. The burner (fig. 4) is a hollow web-shaped metallic casting fitting within the base casting and is provided on its under surface with a number of jet perforations (g–h), through which the flames issuing from the ignited gas are projected directly against the bottom plate of the base casting. The web shape of the burner is intended to radiate and distribute the heat uniformly. A mixing chamber is provided wherein the cold air and gas are mixed. The intent of the chamber is to supply cold air to the burner for combustion at a constant rate and to prevent the escape of mixed hot air and gas through the mixing chamber into the atmosphere. This mixing chamber (fig. 2, e) is screwed into the rear end of the tube leading to the burner, is open at the top, and forms a part integral with the handle plate. A number of air ports are provided around the base of the mixing chamber. Its upper end carries a bridge wall having a threaded aperture to which an ordinary gas cock on the end of a gas supply is secured. Projecting downward from the cock into the mixing chamber is a nozzle which terminates at about the level of or a little below the air ports.

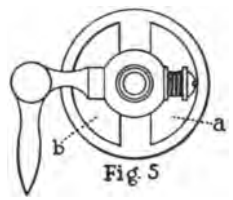

Fig. 5

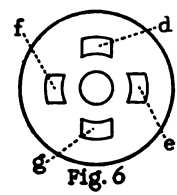

Fig. 6

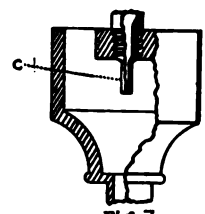

Fig. 7

FIGS. 5 and 6.—Cross-section of mixing chambers of atmospheric gas irons.

FIG. 7.—Cross-section of gas nozzle.

In order to prevent the escape of hot air and gas from the burner to the mixing chamber, there is provided a reservoir which is closed on all sides, excepting for a small opening for the passage of gas from the mixing chamber to this reservoir and another to the burner. The reservoir is formed relatively large at its top and gradually decreases in diameter toward its base, where it leads into the tube communicating with the burner. In spite of the desire of the designers of this iron to have a mixing chamber which would not permit gas to escape to the outer air, the odor of escaping gas at the openings of the mixing chamber was often noticed. Further, the provision for the admission of secondary air is not quite adequate.

(2) The next type of gas iron (figs. 8 and 9) has at its base, and running lengthwise in the combustion chamber, a slot which extends from the heel to the toe of the iron and forms a recess into which the burner (fig. 9, g) is slightly depressed. The burner consists of a metallic tube supported front and rear and held securely in place by a stove bolt. A number of ports suitably spaced for the issuing gas are drilled horizontally on both sides of the burner tube. The latter is so located in the base that the burner ports are elevated sufficiently above the bottom of the combustion chamber to provide for any increase in the length of the flames caused by an increase in the gas pressure.

Secondary air is supplied through a number of drilled openings or slots (fig. 8, c) on each side of the iron. These slots run crosswise from the side

through the base and open into the central slot referred to above. A further supply of secondary air is derived from two larger drilled openings in the rear wall of the iron equally spaced on each side of the burner and on the same level. Provision for the escape of the products of combustion is made by the fluting of the upper edge of each side wall (fig. 9, h). The mixing tube is screwed into the rear end of the burner. The gas connection is a corrugated nozzle with a nonadjustable primary air intake, which consists of a number of drilled openings. In this type of gas iron no gas odor was detected issuing from the ports in the air-mixing chamber.

(3) The third type of iron here described consists of four separate parts: The base, the burner and mixing chamber, the side-wall frame, and the plate and handle. (Figs. 10, 11, 12.) The base consists of a casting provided with a continuous opening on each side of the iron, thus forming two slots leading to a central slot which runs lengthwise in the base of the iron. Through these slots on each side of the iron secondary air is admitted. The bar burner consists of a casting provided with a number of openings drilled on the bottom for the issuing gas jets. The burner is placed so as to have the flames impinge at a distance from the base of the iron sufficient to prevent cooling of the flames and to allow for the extension of the length of the flames due to a possible increase

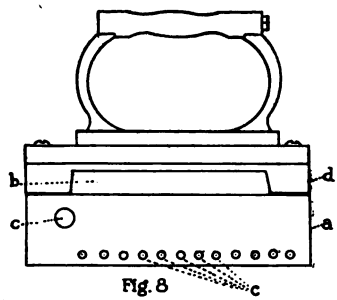

Fig. 8

FIG. 8.—Elevation of atmospheric gas iron, Type 2.

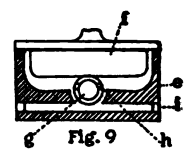

Fig. 9

FIG. 9.—Cross-section of above.

in gas pressure. The products of combustion pass around the outer side of the bar burner and up along the walls of the iron to the outer air, through the space between the wall and the handle plate.

The air-mixing tube is screwed to the rear of the burner and is provided with a sufficient number of openings for the admission of primary air. With this type of iron no gas odor was detected at the openings of the air-mixing chamber. All of the parts of the iron are held together by one nut at the top of the handle plate, thus rendering it easy to separate or to reassemble the parts of the iron.

Blower irons.—A "blower" iron is one heated by gas with the aid of air forced in under pressure. It is practically an iron heated by a blast lamp. In a Bunsen burner about one-third of the total amount of air, the so-called primary air, necessary to burn the gas completely is supplied through the air openings and the remainder is supplied as secondary air at the point where the gas is burned. In a "blower" iron all the air necessary for complete combustion is supplied to the gas before the latter is burned. This results in better combustion and, in addition, a higher flame temperature is secured. The iron proper is usually formed of a metal casting with a heat chamber and a burner process communicating with it. The burner consists of a hollow cylinder or supply pipe for the passage of gas and is provided with a gas aperture which

FIG. 10.—ATMOSPHERIC GAS IRON, TYPE 3, GENERAL VIEW.

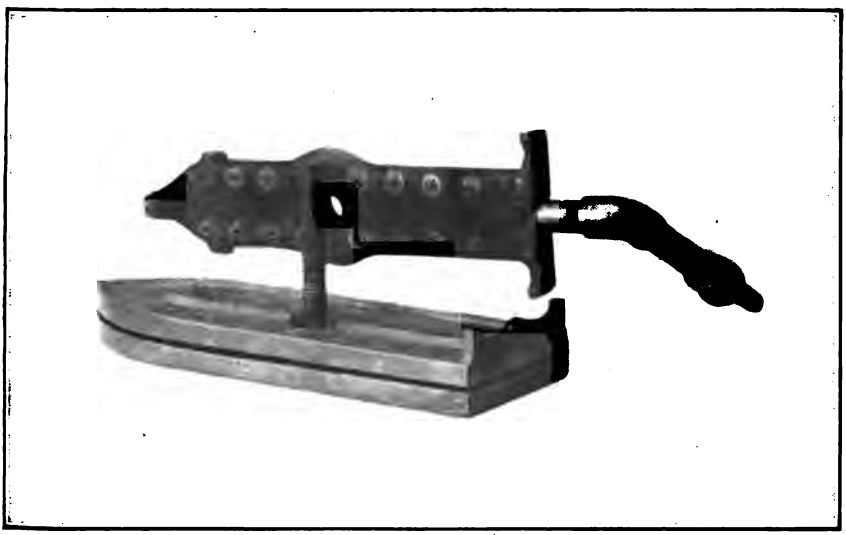

FIG. 11.—THE SAME AS FIGURE 10 WITH HANDLE PLATE REMOVED.

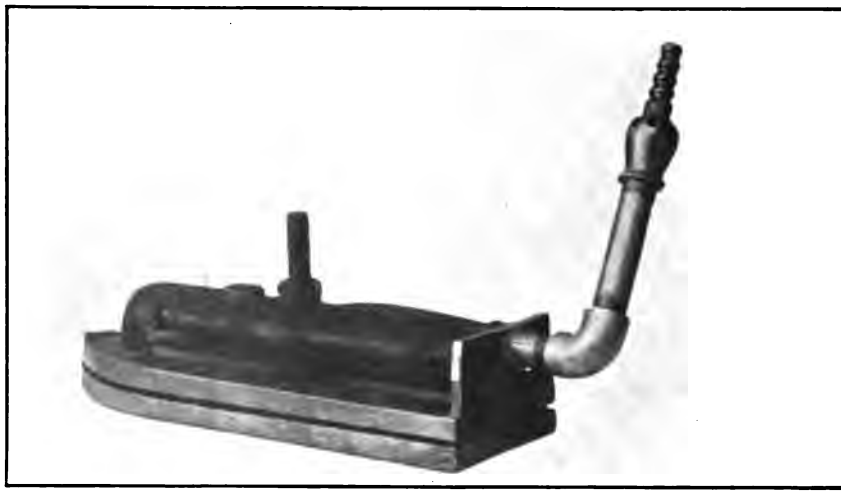

FIG. 12.—THE SAME AS FIGURE 10 WITH BOTH HANDLE PLATE AND BAR BURNER REMOVED.

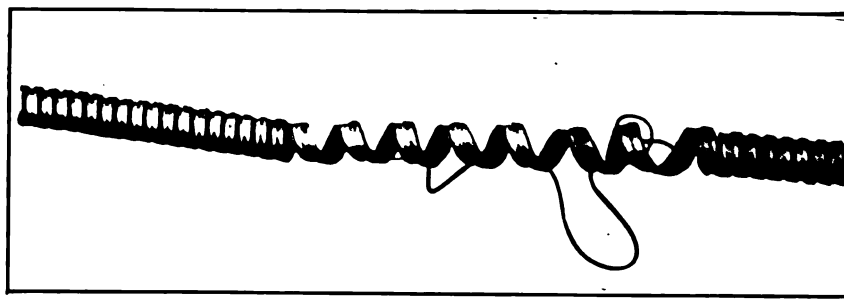

FIG. 21.—CONSTRUCTION OF FLEXIBLE METALLIC TUBING.

is covered with a screen of wire gauze. The latter serves to prevent the flame within the iron from flashing back to the point where the air and gas are mixed and also to mix the gas and air which are supplied through the tube. The cavity of the iron, or the heat chamber, is provided with a hinged door or gate which fits loosely when closed so as to permit the escape of the products of combustion.

When the burner is in place the gases emitted through the screen are protected under pressure into the combustion chamber, the products of combustion finding their way out as mentioned above.

Fig. 13

FIG. 13.—Blower iron and method of attachment to gas and air supply.

The manner of connection of the gas iron to the gas and air supply is shown in figure 13. Two separate pipe lines conduct the gas and the air, respectively. The air is supplied under pressure by means of a blower connected with a motor. A Y tube leads the mixture of gas and compressed air to the gas hose, which is fitted over the burner tube of the gas iron. By a suitable adjustment of the stopcocks leading from the gas and the air supply a proper combustion mixture is obtained. Between 5.5 and 6 cubic feet of air are used per cubic foot of gas.

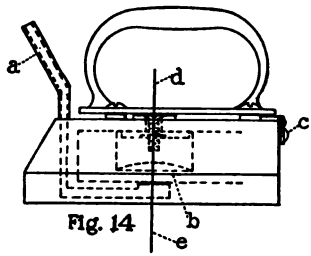

Fig. 14

FIG. 14.—Longitudinal section of blower iron.

Fig. 15

FIG. 15.—Cross section of same.

The different makes of blower irons differ principally in the arrangement of the heat-distributing devices inside the hollow of the iron. The heat chamber of some blower irons is provided with a vaultlike iron plate forming a roof like

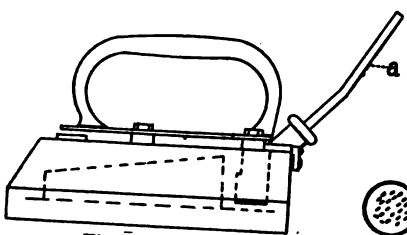

Fig. 16

Fig. 19

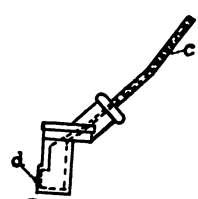

Fig. 20

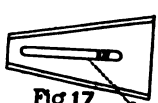

Fig. 17

Fig. 18

FIG. 16.—Section of blower iron.
FIG. 17.—Flame deflector in base of blower iron.
FIG. 18.—Sleeve for wire gauze.
FIG. 19.—Screen of wire gauze.
FIG. 20.—Tube admitting gas and air mixture into iron through opening provided with wire gauze screen (d).

an inverted U in the hollow part of the chamber; others have a more or less rectangular vault; still others are provided with disk or bell shaped pieces of iron attached to the upper wall of the hollow chamber of the iron. All the

arrangements are intended to deflect the heat to the bottom of the iron. To distribute the heat evenly over the bottom, various deflecting devices are used—some irons have corrugated surfaces; others have variously shaped elevated ridges with variously spaced flanges to divide the flame and distribute or deflect the heat advantageously. The reader is referred to figures 14 to 20 for further details of the construction of blower irons.

COMPARISON OF ATMOSPHERIC AND "BLOWER" IRONS.

In the present investigation, although one type of atmospheric pressing iron gave practically no carbon monoxide, taking all types of such irons into consideration, it may be stated that, as regards air contamination from carbon monoxide, properly regulated blower irons are preferable to ordinary gas irons. In this connection, however, it should be remembered that blower irons at times are not easy to regulate; that there may be an improper adjustment of the gas and air mixture, causing a discharge of gas into the room; and that the noise of blowers may have a tendency to produce nervous irritation. It seems well, therefore, to compare the two classes of irons in detail.

DEFECTS OF ATMOSPHERIC PRESSING IRONS.

The structural defects in atmospheric gas-heated pressing irons may be thus summarized:

If the burner is too near the base, an increase in the gas pressure causes the flames to impinge on the base of the iron, cooling the flame and resulting in improper combustion. To obviate this difficulty, some manufacturers of gas irons have drilled the perforations for gas in the burner bar at an angle or raised the bar to a suitable distance above the base of the iron, so as to give more leeway for variations in the length of the flame due to fluctuations in the gas pressure.

If the burner ports are too close together, there may be an insufficient supply of secondary air to each flame for its proper combustion. On the other hand, if the ports are too far apart, the adjacent flames will not communicate with each other soon enough when the burner is first lighted, thus permitting for a time an escape of unburned gas. There must also be a sufficient number of ports of proper dimension for the issuance of the gas flames. If the mixing tube is too short, a fluctuating flame will be produced in the first few ports, or it may skip them entirely, due to the fact that the gas has a high velocity at this point and a positive pressure has not yet been formed. On the other hand, if the mixing tube is too long, the result is a partial loss of the energy of the gas and air mixture, a reduction in the capacity of the burner, and the production of a dull flame.

Secondary air should be admitted to the interior of the iron below the burner, which should be held firmly in its proper position and yet so placed that it may be readily removed when required. Ample provision should be made for the escape of the products of combustion, preferably at the upper wall. Bends in the mixing tubes should be avoided whenever possible, as they tend to obstruct the flow of the gas and air mixture, reducing the capacity of the burner, and may produce lazy flames.

If the air mixer, the ports for the admission of air, and the orifice for the entrance of gas are not of proper design, there will be an escape of gas from the air inlet openings to the outer air. The burner and air mixer must also be so constructed as to prevent a flash back of the flame. The striking back of the flame which sometimes occurs when a gas iron is first lighted is due to the fact that an explosive mixture is present in the burner. This mixture generally occurs when a match or flame is applied to the burner before the proper mixture of gas and air has an opportunity to replace completely the air present in the mixing tube and results in the formation of acetylene, a gas having a peculiar, characteristic odor. Whenever an iron is poorly constructed, so that it takes some time after a light has been applied to a burner before the gas jets ignite, or whenever incomplete combustion takes place, the carbon monoxide present in illuminating gas is discharged into the air.

In addition to the structural defects of atmospheric gas-heated pressing irons the following defects must be considered:

(1) Partial clogging up of one or more gas ports in the gas burner in the interior of the iron by pieces of material rubbed off from the rubber tube conveying gas to the pressing iron, or by material from other sources getting into the openings of the burner, results in an additional discharge of poisonous carbon monoxide into the air of the workroom.

(2) A further source of air contamination results from the flash back which may occur by drafts striking the burner or by sudden fluctuations in the gas pressure.

(3) While an iron is being lighted the flames sometimes project outside the iron, thus making possible the ignition of inflammable cloth near the iron, in this manner starting a fire.[1]

DEFECTS OF BLOWER IRONS.

While better combustion is obtained with blower than with ordinary gas irons, there are a number of objectionable features in connection with blower irons:

[1] Recognizing the danger of fire by gas irons, the New York fire department in 1914, in a publication entitled "Fire Prevention Lessons," states, "Some gas irons are dangerous. Only irons approved by the fire department should be used."

(1) Blower irons are noisy. Continuous exposure to such noise must prove a source of nervous irritation.

(2) The intense heat of the blower iron acts on the end of the rubber tube which is in direct connection with the metal tube leading the gas and air to the iron and spreads the rubber, thus forming between the interior of the wall of the rubber tube and the metal tube of the blower iron a space through which some unconsumed gas escapes into the air of the workshop.

(3) During warm weather workers complain that the intense heat produced by the blower irons is distressing, producing discomfort and resulting in a feeling of lassitude and slowing up of work.

(4) Flying lint from the air of the shop is sometimes drawn into the blower and forced through the pipes. This is liable to stop up one of the blower irons and cause the gas to go out. It may happen as a result of this that the air blast striking the obstruction made by this lint is deflected back and this deflected air current may then extinguish all the flames of the pressing irons in the blower system. This happened in one of the largest clothing establishments in New York City.

(5) An inexperienced person will find much greater difficulty in operating a blower iron than in operating an ordinary atmospheric iron. It is often not easy to adjust the mixture of gas and air so as to be readily combustible. This results in numerous attempts to light the gas.

(6) As a consequence of this greater difficulty in properly lighting the flame of a blower iron, the accompanying flareback of the flame on first lighting the iron, or the use of a number of matches before finally getting a satisfactory flame, is more likely to start a fire in careless hands than with the use of an ordinary gas iron. Besides this, considerable quantities of illuminating gas are discharged into the workroom during such attempts.

III. PERMEABILITY TESTS OF GAS TUBING AND GAS CONNECTIONS.

TESTS OF WALLS OF GAS TUBING.

In addition to carbon monoxide derived from defective gas irons, another source of contamination of the air is the diffusion of illuminating gas through the walls of gas tubing.[1] Tests of the permeability of the walls of such tubing to illuminating gas were therefore undertaken in order to determine the extent of such leakage.

TYPES OF GAS TUBING.

Gas tubing may be divided into: (1) Tubing made essentially of rubber; (2) composition tubing; (3) flexible metal tubing; and (4) flexible steel-frame tubing.

(1) *Tubing made essentially of rubber.*—Some of this tubing has an interior spiral frame of wire surrounded by a thin rubber coating covered with glycerine and glue, with an outer braiding. The type of tubing which was found to have an extensive use in connection with gas irons has a rubber center surrounded by several layers of cloth or canvas, followed by a very thin rubber coating, and finally a thin canvas covering.

(2) *Composition tubing.*—This tubing consists of a framework of spirally wound wire covered with paper or cloth braid dipped in varnish or glycerine and glue. The coating of composition is first wrapped with thin paper and then with cloth braid as an outer finish. While this flimsy type of tubing is sold in 5 and 10 cent stores and in department stores, its use was not encountered in the garment trades.

(3) *Flexible metal tubing.*—The first United States patent for flexible metal tubing was taken out in 1860. The tube was of lead and was covered with a braiding. Tubing made of this material is not sufficiently flexible to be suitable for use in connection with gas appliances such as gas irons which are constantly moved back and forth.

The flexible metal tubing that finds extensive use consists of a long, narrow band of spirally wound steel, forming on the interior a continuous interlocking joint, which is packed, for greater tightness, with a filament of rubber or of asbestos. (Fig. 21, facing p. 20.)

(4) *Flexible steel-frame tubing.*—A skeleton framework, similar to that described above (3), is reinforced with the following coverings: Cloth braiding,

[1] According to the National Commercial Gas Association, the annual consumption of tubing in the United States for gas stoves, portable appliances, and gas irons in 1914 was about 25,000,000 feet, at prices ranging from 1¼ to 10 cents per foot.

a composition of glycerine and glue, over this cloth braiding, a paper wrapper, and, finally, an exterior cloth covering to give the tube a finished appearance. While such tubing is an improvement over flexible steel tubing alone, it is still far from being a desirable tubing for conveying artificial illuminating gas.

HISTORICAL REVIEW OF PERMEABILITY TESTS OF RUBBER TUBING.

As early as 1831 Mitchell (33) recognized the fact that gases were diffusible through sheet rubber. In measuring this permeability he used a siphon of glass having a lower end enlarged so as to form a funnel over which was fastened the rubber sheet to be examined. He inverted this siphon and poured mercury into the longer arm, thus confining in the shorter limb a portion of the air which was in communication with the rubber disk. Over the latter, in a trough of mercury, was placed the vessel containing the gas to be examined, and the velocity of penetration of the gas was measured by the time required to elevate to a given distance the mercurial column in the other limb. Mitchell found that when there was air on one side of the rubber membrane various kinds of gas passed through with different velocities. For equal volumes of different gases he found the rates of passage through a rubber membrane as follows: Ammonia, 1 minute; hydrogen sulphide, 2 minutes; carbon dioxide, 3½ minutes; nitrous oxide, 6½ minutes; arseniuretted hydrogen, 27½ minutes; olefiant gas, 28 minutes; hydrogen, 37½ minutes; oxygen, 113 minutes; carbon monoxide, 160 minutes.

Mitchell also found that the penetration of rubber by gas could be shown by its passage into a vacuum as well as into an atmosphere of another gas. He used a long glass tube, nearly a meter in length, closed at one end by a rubber membrane. On filling the tube with mercury and inverting the open end into a mercury trough he obtained a vacuum above the mercury column into which atmospheric air gradually penetrated the rubber membrane and depressed the mercury column in the tube. He measured the rates of diffusion of different gases through the rubber by noting the time it took equal volumes of different gases to lower the mercury within the tube. Having found the time of passage of carbon dioxide to be the shortest, he took this as unity and gave the following figures for the results obtained:

TABLE V.—*Penetration of rubber by equal volumes of gas* [Mitchell].

Gas.	Time.
Carbon dioxide	1
Hydrogen	2.470
Oxygen	5.316
Olefine	6.326
Atmospheric air	11.850
Carbon monoxide	12.203
Nitrogen	13.585

In measuring the permeability of a gas through rubber, Le Roux (31) in 1866 used either a cylindrical or a conical vessel covered by a sheet of the material under examination. The vessel was filled with a gas and the diffusion estimated from the decrease in volume at the end of an hour.

In the same year Aronstein and Sirks (2) made permeability measurements by using an apparatus which consisted essentially of a piece of rubber tubing plugged up at the end, connected at the open end to a vessel filled with hydrogen. The manometer of the vessel was so adjusted that the pressure

of a constant volume of gas was read. The amount of diffusion, as measured by the diminution of volume, was calculated from the following formula:

$$d=1-\frac{H'(1+\alpha t)}{H(1+\alpha t')},$$

where d represents the diminution in volume, H and t represent the pressure and the temperature at the beginning, H' and t' the pressure and temperature at the end, and α is the coefficient of cubic expansion.

Reychler (46) described an experiment of Pictet, who took a glass tube open at both ends, closed one end by a thin sheet of rubber, then filled the tube with mercury and inverted it in a trough of the same metal. On introducing a gas into this mercury tube, or barometer, as the gas diffused through the rubber partition to the outer air, the column of mercury rose inside the tube, the amount of diffusion being measured by the amount of rise of the mercury column.

In 1907 Ditmar (9) measured the diffusion of illuminating gas through rubber tubing by the diminution in the volume of gas originally present and the subequent rise in a column of sulphuric acid. He passed the gas first through a flask of concentrated sulphuric acid and a calcium chloride tube to remove moisture from the gas, then through a piece of rubber tubing which was connected to a graduated glass tube leading almost to the bottom of a bottle containing concentrated sulphuric acid. Through another opening in the stopper of this bottle there passed a calcium chloride tube to keep away moisture from the sulphuric acid. The difference in the height of the column of sulphuric acid in the graduated tube between the position before passing in illuminating gas and after passing illuminating gas for a given time was a measure of the diffusion through the rubber tube.

Fayol (14), in 1909, described a rather crude method of estimating the permeability of rubber for gas. This consisted in placing on a balance a rubber flask which communicated with a manometer. From the diminuition in weight of the rubber flask and from the decrease in barometric pressure the amount of diffusion of gas through the rubber was estimated.

In 1912, Steinitzer (60) measured the diffusion of gases through a rubber membrane by passing the gas through the opening of a bottle connected with a manometer into a vessel resembling two hemispheres separated by a sheet of the rubber to be tested. From the upper hemisphere a delivery tube passed into the bottom of a tube filled with mercury, dipping into a trough of the same metal. Gas diffusing through the rubber membrane displaced the mercury in the tube and the volume of gas in the tube containing mercury was a measure of the amount of gas that diffused through the tubing. The diffusion was expressed as the number of cubic centimeters of gas per square centimeter of rubber surface.

METHOD USED IN THIS INVESTIGATION.

Examination of the foregoing methods showed that none was suitable for the measurement of the permeability of illuminating gas through the walls of gas tubing in terms of the poisonous constituent carbon monoxide gas. After some experimentation the following method was therefore selected:

The tube to be tested for permeability was inclosed in a long glass tube (fig. 10), through one end of which it was connected to the gas supply by means of a meter provided with a pressure

gauge and mercury governor regulating the pressure; the other end of the gas tube was connected by means of a short piece of tubing to a small Bunsen burner so as to provide a constant passage of gas through the tube undergoing a test. The glass tube inclosing the gas tubing had one end open to the air, the other end was connected with a purifying train of absorption vessels designed to hold back all gas-leakage products that could interfere with the determination of carbon monoxide. Aspiration at one end of the apparatus would draw through it any leakage products that had diffused into the outer glass tube together with air of the room. The diffused carbon monoxide was passed over heated iodine pentoxide in the manner previously described, the iodine liberated being absorbed in a potassium iodide solution and the amount of iodine found by titration with N/1,000 sodium thiosulphate. The value thus found, less the value for a blank analysis of the air of the room, was the measure of the carbon monoxide which had been diffused through the walls of the tube.

By referring to figure 22 the apparatus used in the tests may be examined in greater detail. The gas tube T undergoing a permeability test was inclosed in the long glass tube R (about 100 cm. long and 4.4 cm. wide). This was closed at each end by means of a stopper provided with two holes, one of which served for the passage of the gas tube. Through the stopper at the admission end, Z′, of the tube there passed a short piece of glass tubing provided with a stopcock on the outside of the stopper for the entrance of the air of the room. Through the stopper at the other, or exit, end, near Z^2, there passed another glass tube with a stopcock also on the outside of the tube, R. The tube at Z^2 was directly connected with the train of purifying absorption bulbs and these with the iodine pentoxide tube, iodine absorption bulb, and aspirator. The gas tube T was directly connected with the gas supply measured through the meter M, which was supplied with a pressure gauge and a mercury governor regulating the pressure. The exit end of the gas tube was directly connected by means of a short piece of tubing to a small Bunsen burner, b, so that a constant flow of gas was taking place all the time through the gas tube to be tested. The products of leakage in the gas tube T would therefore pass through its walls to the outer inclosed space of the glass tube. Upon starting aspiration the leakage products, if any, together with the air of the room (entering at Z′) would be swept through the apparatus and the diffused illuminating gas measured in terms of carbon monoxide.

The purifying train consisted of the absorption bulbs K, containing concentrated sulphuric acid to dry the air and to remove some of the unsaturated hydrocarbons, and bulbs H containing

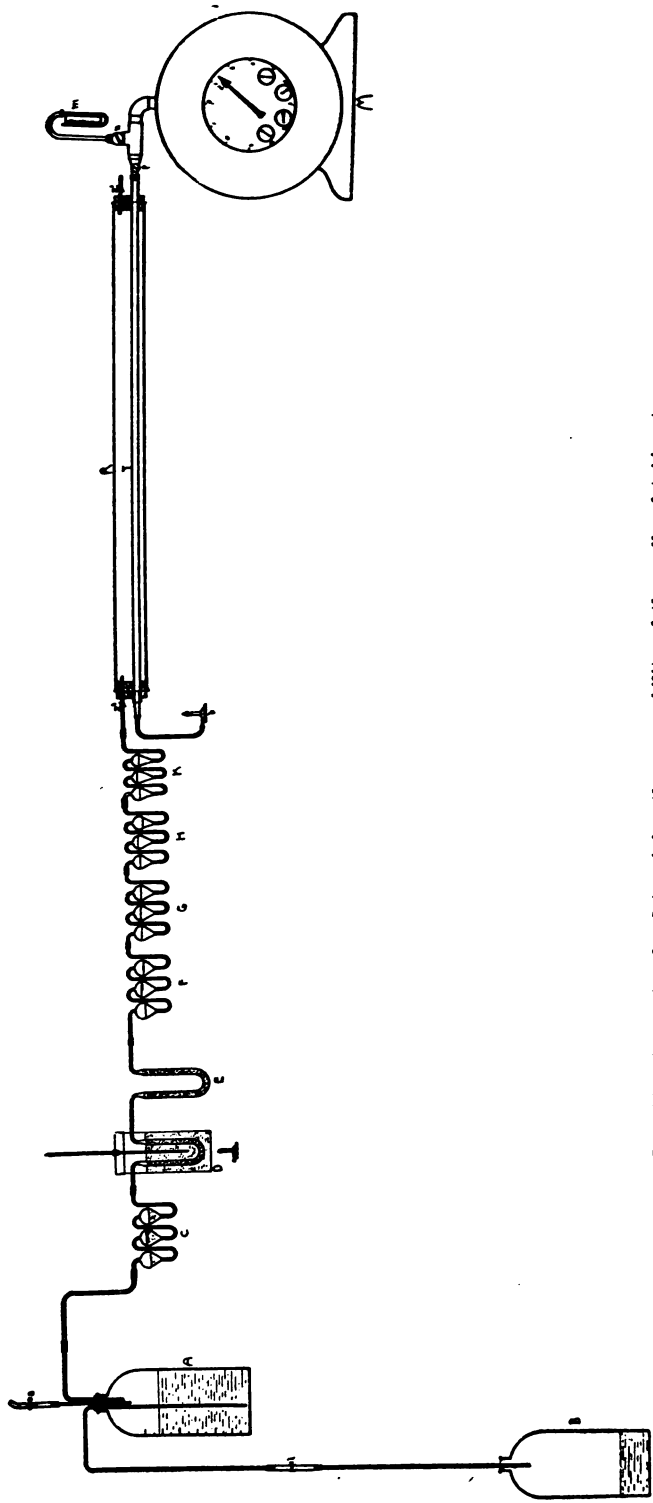

FIG. 22.—Apparatus for determining the permeability of the walls of tubing to gas.

fuming sulphuric acid to retain unsaturated hydrocarbons. The rest of the apparatus was as described in connection with the analysis of air samples from workshops (p. 8).

To render the cork stoppers gas tight their surfaces were coated with water glass, and this was then allowed to dry; the small spaces between the stopper and the tubing going through it were packed with cotton wadding saturated with water glass. On drying, the water glass formed an impervious coating. The round surface of the stoppers was covered with tin-foil and fitted tightly into a glass tube, the points of contact between the stoppers and the glass tube being also coated with water glass. The joints of the various absorption bulbs were connected by short pieces of tight rubber tubing, the glass ends of the separate bulbs were made to touch end to end, and the points of contact of glass tubes and rubber connections were coated with water glass. No collodion or similar material was used to seal joints, as it was desired to exclude organic matter, which reacts with the reagent iodine pentoxide.

To begin a determination, the iodine pentoxide was first heated to 150° C., all the connections made tight, the reading on the gas meter noted, the gas pressure regulated to 2 inches of water column[1] by adding weights on the mercury seal of the governor, the gas lighted at the Bunsen burner *b*, and the flame adjusted so as to burn a fixed quantity of gas, say, one-fourth of a cubic foot per hour. Aspiration was started by blowing into the tube *a*, which permitted the water from the reservoir A to start flowing into the bottle B, and the stop cocks Z′ and Z² were opened, so as to permit the diffused gas to pass through the apparatus. The rate of aspiration, regulated by the pinch cock at 1, was so adjusted as to aspirate air through the apparatus at the rate of about 1 liter per hour. Aspiration was continued for four hours, when the potassium iodide absorption bulb was removed, the contents transferred to a small beaker and titrated with N/1000 sodium thiosulphate until the disappearance of the iodo-starch blue. Each c. c. of N/1000 sodium thiosulphate was equivalent to 0.056 c. c. of carbon monoxide at 0° and 760 mm. pressure. At the conclusion of the four-hour test the gas supply was shut off and the reading of the gas meter taken. Air from the room was now swept through the apparatus until no free iodine was carried over from the iodine pentoxide tube, and a correction made for the amount of carbon monoxide here found. For gas tubes with a small permeability, aspiration for a half hour to an hour sufficed; for tubes with greater permeability a longer aspiration was required. To

[1] As the pressure of gas furnished in New York City may be as high as 6 inches of water, and as the average pressure is about 3 inches, it is evident that with the greater pressure the results for the permeability of the walls of tubing to illuminating gas be greater than under the conditions of the experiment.

compensate for the carbon monoxide contained in the room, blank analyses of the air of the room were made under the same conditions as in the regular test and with aspiration of like amounts of air. The amount of carbon monoxide in the air of the laboratory was deducted from the total. The number of cubic centimeters of carbon monoxide thus found, divided by the number of hours the gas diffused through the tube undergoing a permeability test, and by the length of this tube in feet, gives the number of cubic centimeters of carbon monoxide per foot per hour diffused through the walls of the gas tube under the gas pressure used. As the pressure varies at different times of day, for the purpose of getting comparative results, a uniform gas pressure of 2 inches of water was used throughout all the tests. The governor for regulating gas pressure was of the standard type used by gas companies.

RESULTS OF TESTS ON TUBING.

Sixty-eight permeability tests were made on the walls of 30 pieces of gas tubing. The tests included 16 different varieties of tubing.

These results show (1) that none of the gas tubes tested was found to be gas tight; (2) that the walls of tubing through which illuminating gas had been passed before making a test were more permeable to the gas than in the case of brand new tubing; (3) that rubber tubing is the least permeable to illuminating gas; (4) that flexible metal tubing and "composition" tubing give considerable leakages of illuminating gas.

The following tables set forth in tabular form the results of these tests:

TABLE 6.—*Permeability tests on new rubber tubing.*

Description of tubing.	Average thickness of wall (inches).	Length of tubing (feet).	Duration of test (hours).	Gas pressure (inches of water).	Cubic feet of gas per hour.	Carbon monoxide.	
						Total (c. c.).	Per foot of tubing per hour (c.c.).
Red outside, black inside, cloth insertion, ⅜-inch, used for ordinary gas irons	0.1137	3	4	2	0.29	0.0420	0.0035
					.27	.0392	.0032
					1.0	.0392	.0032
					2.0	.1232	.0102
					3.0	.0528	.0044
					4.0	.0140	.0011
Red outside, black inside, cloth insertion, ¼-inch, used for blower irons	.1045	3	4	2	.25	.0392	.0032
					1.0	.0616	.0051
					2.0	.0168	.0014
					3.0	.0112	.0009
					4.0	.0448	.0037
Red outside, white inside, cloth insertion, ⅜-inch, used for ordinary gas irons	.1361	3	4	2	.25	.2408	.0200
					1.0	.0336	.0028
					2.0	.0784	.0065
					4.0	.0252	.0021
Red outside, white inside, cloth insertion, ¼-inch, used for blower irons	.1109	3	4	2	.25	.6776	.0564
					1.0	.1904	.0158
					2.0	.1288	.0101
					3.0	.3024	.0252
					4.0	.0896	.0074

TABLE 7.—*Permeability tests on rubber tubing after passing gas through same for 60 hours and for 30 days (240 hours).*

Description of tubing.	Average thickness of wall, in inches.	Gas pressure, in inches of water column.	Cubic feet of gas per hour.	Cubic centimeters of carbon monoxide per foot of tubing per hour.		
				New tubing.	Tubing after passing gas for 60 hours.	Tubing after passing gas for 30 days, or 240 hours.
Red outside, black inside, cloth insertion, $\frac{1}{4}$ inch, used with blower gas irons	0.1044	2	0.29	0.0035	0.0114	0.0810
			1.0	.....	.....	.1639
			4.0	.....	.0392	.1148
Red outside, black inside, cloth insertion, $\frac{3}{8}$-inch, used with ordinary gas irons	.1136	2	.25	.0035	.....	.0943

TABLE 8.—*Permeability tests on rubber tubing that had been used in shops of the garment industry.*

Shop No.	Kind of tubing.	Kind of gas iron with which used.	Length of time said to have been in use.	Condition of tubing.	Gas pressure, in inches of water.	Cubic feet of gas per hour.	Cubic centimeter of carbon monoxide per foot of tubing per hour.
1	Rubber, $\frac{3}{8}$-inch, cloth insertion.	Ordinary	4 months	Part of outer layer peeled off.	2	4	0.2047
2	Rubber, $\frac{1}{4}$-inch, cloth insertion.	"Blower"	6 months	Old looking	2	4	.1568
3	.....do.....	...do.....	8 months	Cracks in outer layer of tube.	2	4	.2406
4	Rubber, $\frac{3}{8}$-inch, cloth insertion.	Ordinary	1 year	Part of tube seared	2	4	.3564
5	Rubber, $\frac{1}{4}$-inch, cloth insertion.	"Blower"	...do.....	Part of outer layer peeled off.	2	4	.2969

TABLE 9.—*Permeability tests on miscellaneous rubber tubing.*

Description of tubing.	Condition of tubing.	Length of tube, in feet.	Number of hours of test.	Gas pressure, in inches, of water.	Cubic feet of gas per hour.	Carbon monoxide.	
						Total (c. c.).	Per foot of tubing per hour (c. c.).
Double coat of rubber, outer coat gray, inner coat red.	New	3	4	2	0.275	0.0224	0.0013
(1) Core of rubber in 2 layers with 4-ply cloth insertion between; (2) composition; (3) exterior braiding.	.....do.....	3	4	2	.25	.0896	.0074
Inner black, outer red coat covered with wire spring.	.....do.....	3	4	2	.25	.0168	.0014
Rubber, with interior wire spring.	.....do.....	3	4	2	.275	.0672	.0056
(1) Wire coil; (2) rubber; (3) composition; (4) outer cloth covering.	New tubing through which gas was passed for 60 hours before test.	3	4	2	1.0	.0784	.0065
(1) Wire coil; (2) black rubber; (3) layer of thin paper; (4) green cotton braiding; (5) olive-green outer cloth covering.	New tubing through which gas was passed for 30 days (240 hours) before test.	3	4	2	.25	.0112	.0009

TABLE 10.—*Permeability test on new flexible metal tubing.*

Material.	Description.	Length of tubing, in feet.	Duration of test, in hours.	Gas pressure, in inches, of water.	Cubic feet of gas per hour.	Carbon monoxide.	
						Total (c. c.).	Per foot of tubing per hour (c. c.).
Metal	Flexible, No. 1	3	4	2	0.275	0.6832	0.0569
					.26	.9072	.0756
					1.0	.1288	.0107
					2.0	.2296	.0191
					3.0	.4876	.0406
					4.0	.3472	.0289
					6.0	.7224	.0602
Do	Flexible, No. 2	3	4	2	.27	.4088	.0340
					1.0	.6776	.0564
					2.0	1.3112	.1092
					3.0	.9184	.0765
					4.0	.6608	.0550
					6.0	.7906	.0658
Do	Flexible, No. 3	3	4	2	.275	2.6264	.2188
Do	Flexible, No. 4	3	4	2	4.0	.3360	.0280
					6.0	.2352	.0195

TABLE 11.—*Permeability tests on flexible metal tubing after passing gas through same for 60 hours and for 30 days (240 hours).*

Description.	Gas pressure, in inches, of water.	Cubic feet of gas per hour.	Cubic centimeters of carbon monoxide per foot of tubing per hour.			Remarks.
			New tubing.	Tubing after passing gas through for 60 hours.	Tubing after passing gas through for 30 days, or 240 hours.	
Flexible No. 1, metal	2	½	0.0340	0.1045	0.2281	2 hours' test instead of usual 4 hours.
		1	.....	.....	.4610	
		4	.....	.....	.2584	
Flexible No. 2, metal	2	½	.....	.....	.2743	
		4	.0289	.....	.0812	
Flexible No. 3, metal	2	0.275	.....	.2188	.7435	Do.

TABLE 12.—*Permeability tests on flexible metal tubing that had been used in shops of the garment industry.*

Shop No.	Kind of gas iron with which used.	Length of time said to be in use.	Condition and appearance of tubing.	Gas pressure, in inches of water.	Cubic feet of gas per hour.	Cubic centimeter of carbon monoxide per foot of tubing per hour.
1	Ordinary	3 months	Apparently good condition; old appearance.	2	4	0.4205
2	do	6 months	Apparently good; appearance dark	2	4	.5837
3	do	1 year	Apparently good; appearance old	2	4	.8614

TABLE 13.—*Permeability tests on composition tubing.*

Description of tubing.	Condition of tubing.	Length of tube tested, in feet.	Number of hours of test.	Gas pressure, in inches of water.	Cubic feet of gas per hour.	Carbon monoxide.	
						Total (c. c.).	Per foot of tubing per hour (c. c.).
(1) Core of galvanized-iron spring; (2) layer of thin paper; (3) cotton braiding; (4) composition, glycerin and glue; (5) outer braiding.	New	2	4	2	1	0.0168	0.0014
As above	Gas passed through tube for 60 hours before test.	2	4	2	1	1.9096	.1591
(1) Core of wire spring; (2) layer of thin paper; (3) cotton braiding; (4) composition, glycerin and glue; (5) layer of thin paper and loose strands of thread; (6) layer of asbestos; (7) wire coil.	New	2	4	2	.275	2.0160	.1680
As above	Gas passed through tube for 60 hours before test.	2	4	2	.275	3.0408	.2534

DISCUSSION OF RESULTS.

Rubber tubing.—Thirty-seven permeability tests were made on the walls of 17 samples of rubber tubing. These tests included 10 different varieties of tubing. In the case of new rubber tubing, such as is used for gas-heated pressing irons in the garment industry, the smallest leakage was 0.0009 c. c. and the greatest 0.0564 c. c. of carbon monoxide per foot of tubing per hour. The average for 20 specimens of tubing examined was 0.0093 c. c. of carbon monoxide per foot of tubing per hour.

The average permeability of 10 new rubber tubes of the kind used for ordinary gas irons was 0.0057 c. c. of carbon monoxide per foot of tubing per hour. The average thickness of the walls of the tubes was 3.172 mm. The average permeability of 10 new rubber tubes of the kind used for blower irons was 0.0129 c. c. of carbon monoxide per foot of tubing per hour, and the average thickness of the walls of these tubes was 2.735 mm. Other things being equal, a decrease in permeability of a tube accompanies an increase in the thickness of the walls.

In two cases where new rubber tubing was tested, both when new and after gas had been passed through the tubes for 60 hours, there was a greater leakage in the case of the tubing after gas had been passed through them, in one case the leakage being about 4 times greater and in the other about 10 times greater than in the tubing used for the first time. In four cases where rubber tubing was

tested, both when brand-new and after passing gas through each for 30 days, or a total of 240 hours, there was a great increase in the leakage through the tubes after the prolonged passage of gas. After this treatment the permeability of the rubber tubing ranged from 0.0810 c. c. to 0.1689 c. c. of carbon monoxide per foot of tubing per hour, and the increase in permeability ranged from 23 to 33 times the original permeability.

Old rubber tubing.—Samples of gas tubing that had been in use for different lengths of time were procured from shops in the garment industry by giving in exchange for the old tubing new pieces of equivalent length. One tube that had been in use for six months was old looking, but had no cracks or breaks in the surface. It gave a permeability figure of 0.1568 c. c. of carbon monoxide per foot of tubing per hour. New tubing of apparently the same quality gave a result of 0.0037 c. c. of carbon monoxide per foot of tubing per hour. The worst case was that of a tube that had been in use for a year and was partly seared. This gave a permeability of 0.3564 c. c. of carbon monoxide per foot of tubing per hour, while new tubing of the same quality gave a permeability result of 0.0011 c. c. of carbon monoxide per foot of tubing per hour, or 324 times less.

Miscellaneous rubber tubing.—Permeability tests on four different makes of new rubber tubing gave results ranging from 0.0014 to 0.0074 c. c. of carbon monoxide per foot of tubing per hour. In one case a test was made on a cloth-covered new rubber tube through which gas had been passed for 30 days, or 240 hours, and a permeability result of 0.0009 c. c. of carbon monoxide was obtained per foot of tubing per hour. This is an example of tubing with low permeability.

Flexible metal tubing.—Twenty-seven permeability tests were made on the walls of 11 specimens of flexible metal tubing. The tests included four varieties of tubing. In the case of new flexible metal tubing the smallest leakage of gas was 0.0107 c. c. and the greatest was 0.2188 c. c. of carbon monoxide per foot of tubing per hour, while the average for 16 specimens was 0.0597 c. c. of carbon monoxide per foot per hour. After gas had been passed through these for 30 days, or a total of 240 hours, the lowest result obtained was 0.0812 c. c., while the highest leakage was 0.7435 c. c. of carbon monoxide per foot of tubing per hour. In the case of samples of flexible tubing, in use for various periods of time in the shops of the garment industry, which were obtained by giving in exchange new flexible metal tubing, the results in three tests ran from a minimum of 0.4205 c. c. to a maximum of 0.8614 c. c. of carbon monoxide per foot of tubing per hour. The leakage here was relatively great. Although the tubing had been used for periods of time ranging from three months to a

year, none of the tubing was visibly defective. There were no bends or cracks in these samples, but the metal was dark instead of light in color, as when new.

Composition tubing.—Four permeability tests were made of the walls of two kinds of composition tubing. These tests in one instance gave 0.0014 c. c. and in the other (an asbestos-covered composition tube) 0.1680 c. c. of carbon monoxide per foot of tubing per hour. When gas was passed through these tubes for 60 hours and then tested for permeability, the one which gave 0.0014 c. c. now gave a permeability of 0.1591 c. c. of carbon monoxide per foot of tubing per hour, or about 113 times the original leakage, while the asbestos-covered composition tube gave a permeability of 0.2534 c. c. of carbon monoxide per foot of tubing per hour, or an increase of over 50 per cent in the gas leakage.

DEFECTS OF GAS TUBING.

Rubber tubing.—Owing to the demand for cheap gas tubing a great deal of inferior or worthless rubber hose is on the market. Much of this material is stiff and almost devoid of elasticity. It is reported (30), in connection with a complaint regarding laboratory tubing which, though represented as of the first quality when sold, became hard and inelastic within a short time, that a rough analysis showed 68 per cent of mineral matter. It is no wonder, then, when tubing is made up for the greater part of mineral filler, and when the rubber used is often old scrap rubber, that there should be so much difficulty in procuring a tubing fairly impermeable to gas.

Regarding the diffusion of illuminating gas through rubber tubing, it is stated (30) that there is less diffusion in the case of moderately compounded rubber than in the case of pure rubber and sulphur tubing. India rubber is penetrated by gas, so that the naphtha which is deposited in the walls by condensation from the gas softens the rubber and, in time, destroys its utility. Attempts to protect the interior of such tubes by means of oil varnish have failed, as the varnish cracks, and the gas and its deposits, penetrating the body of the tube, render it leaky. Various modifications in the composition of the rubber have been suggested for rendering the latter less permeable to gas, such as the addition to the rubber of gum shellac, the replacement of the lead by some metallic oxide, as oxide of zinc, and the reduction of the sulphur to the smallest possible amount.

Flexible metal tubing.—While flexible metal tubing may be suitable for conducting water, oil, steam, compressed air, or any gas which is not poisonous, or the escape of which will not contaminate the surrounding air, the ordinary form can not be regarded as suit-

able for conducting a highly poisonous gas like illuminating gas, because, after all, the tube is nothing but a series of joints, any one of which if not tight will become a continuous source of leakage for illuminating gas.

A mere visual examination of a defective flexible metal tube will often fail to reveal the fact that it is a dangerous tube to use, from the hygienic point of view. The exterior of the tube may look well, and breaks or dents may not be visible; yet the tube may be a prolific source of air poisoning.

There are several ways in which it is possible for flexible metal tubing to be rendered worthless. The thin thread of elastic which is used as a packing for the interlocking joints wears out with age, proximity to heat, the action of the gas, and the strain of use.

The constant proximity of a part of the flexible metal tube to a heating appliance, such as a pressing iron or radiator, will affect the thin rubber thread on the inside of the interlocking joints of the flexible metal tube, resulting in the weakening and destruction of the packing. Even if not near a hot appliance, the thin rubber thread is acted on by the gas, being in time weakened and decomposed. In addition to this destruction of the rubber through natural causes, there is the human factor to be considered. Carelessness in the handling of the flexible metal tube, such as a slight twist, is likely to dislocate the rubber thread from its usual position in the groove of the interlocking joints, or the accidental compression of the tube by some weighty object may loosen one or more of the numerous joints. In the case of rubber tubing, such carelessness in handling would not do the damage which is done to flexible metal tubing.

Another objection to the use of flexible metal tubing is that this tubing needs special handling on the part of the dealer. The tubing is sold in prepared lengths of 3, 4, 5, or 6 feet or it is cut from a large roll for the consumer, according to the length required. As to the cutting of the flexible metal tubing, if not done with a sharp hacksaw, there is danger of loosening the rubber thread of the tube. If the dealer stores the metal tube in damp or in overheated places or in places which are too cold or are exposed to sunlight, if other material is piled on the tubing, or if the tubing is hung on hooks, deterioration will set in. It has been stated by a manufacturer (27) of flexible metal tubing, who admitted that metal tubing when not in use is liable to be overbent, that if this kind of tubing were kept by the dealer in strong, suitable boxes and kept covered with well-fitting covers until it reaches the hands of the user, the latter would receive a satisfactory metal gas tubing. This statement assumes that the tubing is originally good. In this connection the writer has

found that flexible metal tubing received direct from manufacturers and carefully stored, when tested for permeability, showed leakage when new, and when tested after allowing gas to pass through the same for 30 days, showed considerable leakage.

The use of asbestos packing for sealing the interlocking joints of flexible metal tubing is far worse than the use of the rubber thread, because if the metal tube is slightly twisted or stretched there is a tendency of the rubber thread to resume its original place, whereas with asbestos this tendency does not exist and a bad leak starts at once.

Composition tubing.—The defects of this tubing are described on page 25.

PERMEABILITY TESTS OF GAS CONNECTIONS.

RUBBER ENDS FOR FLEXIBLE GAS TUBING.

Defective and poorly fitting rubber connections, as a rule, are a greater source of leakage than defective gas tubing. The rubber ends attached to the tubing (one of which is intended to fit over the gas supply and the other over the gas appliance) are often made of reclaimed old rubber scrap. They are consequently rigid, possessing but little elasticity, and often fit badly, even when first used. It is but natural, then, that such rubber ends soon harden, lose the little elasticity originally present, and become so loosely fitting that great gas leakage ensues. Rubber ends made even of good material will in time also spread and harden with use, because of their proximity to the source of heat, thus becoming worthless or even dangerous.

The rubber ends attached to gas tubing not entirely made of rubber are often poorly attached to the tubing, frequently merely with glue. In the case of the ordinary flexible metal tubing, a glue connection is the usual procedure. It is no wonder that such slipshod connections soon become loose or completely detached. In such instances the attempts made by the user to refasten the rubber end to the tube often result in a tube voluminously bandaged, which looks as if it were suffering from some dread disease. Such defective tube ends are a continuous source of gas poisoning to those working in their vicinity. These same unhappy attempts to bandage tubing are often seen in the case of the ends of rubber tubes which have become spread from proximity to heat from a gas appliance, such as a pressing iron.

In some cases hollow wooden plugs are used for the interior of rubber ends. Such wooden plugs should never be used, as they soon become charred or split and then easily fall out.

Attempts have been made to devise means for fastening the rubber end to the tube by the use of metallic bands placed over the cloth

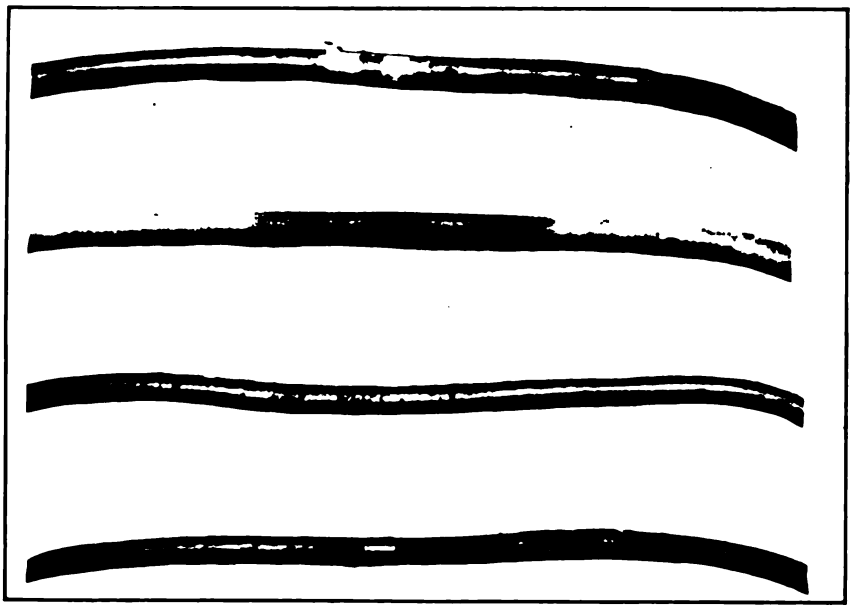

FIG. 23.—DEFECTIVE RUBBER TUBING FOUND IN USE IN SHOPS OF GARMENT INDUSTRY.

FIG. 24.—DEFECTIVE RUBBER ENDS OF RUBBER TUBING AND OF FLEXIBLE METAL TUBING. NOTE BANDAGED RUBBER ENDS OF FLEXIBLE TUBING.

FIG. 25.—DEFECTIVE RUBBER TUBING. NOTE THE CONDITION OF THE RUBBER ENDS, MAKING POSSIBLE CLOGGING OF BURNER OPENINGS OF GAS IRON BY PIECES OF RUBBER FROM TUBING.

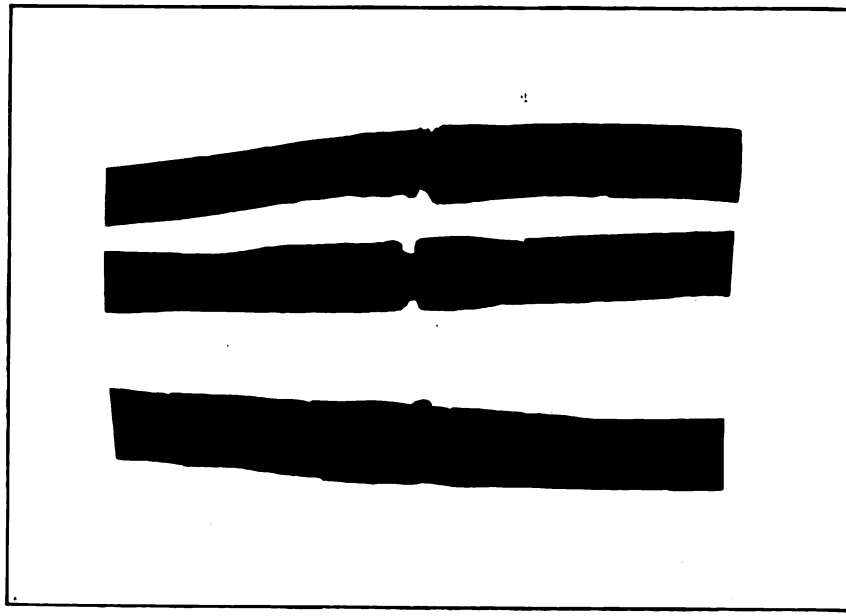

FIG. 26.—JOINTED GAS TUBING FOUND IN USE IN SHOPS OF THE GARMENT INDUSTRY.

braiding of the tube, and, with the aid of glue, to make the connection between tube and rubber end secure. While this procedure may fasten one end of the rubber connection to the tube securely, yet the rubber connection which is pushed or slipped over the gas cock spreads after a time, just as in the case of rubber tubing, so that the gas is likely to escape at this point of connection. Rubber ends, therefore, are not adapted for making permanent connections between gas tubing and the stopcocks of gas appliances in constant use, such as lamps, gas stoves, or pressing irons.

METHOD USED IN PERMEABILITY TESTS.

To get an idea of the extent of leakage through the gas connection between a gas tube and the metal tube leading into a pressing iron when the gas tubing fits tightly over the metal tube of the iron, permeability tests were made on such connections. The arrangement of the apparatus was the same as in the case of permeability tests on tubing as described on page 27, except that in place of a long glass tube inclosing 3 feet of the tube to be tested a short 6-inch glass tube was used which inclosed a piece of rubber gas tubing of about 3 inches in length, fitting over a short length of metal tube of the same kind as that leading the gas from the flexible gas tube into the gas iron. The longitudinal surface of the rubber tube was coated with a layer of water glass and allowed to dry, so as to exclude any permeability from the tube itself. In fitting on the rubber tube over the metal care was exercised to see that the connection was tight.

RESULTS OF TESTS.

The results of these tests are shown in the following table.

TABLE 14.—*Tests on permeability of gas connections.*

Connection between rubber and metal tubes.	Number of hours of test.	Cubic feet of gas per hour.	Gas pressure, in inches of water.	Carbon monoxide.	
				Total (c. c.).	Per hour (c. c.).
Tight	4	1	2	2.4696	0.6174
Do	4	4	2	2.0832	.5208
Do	4	4	2	2.3688	.5922
Do	4	6	2	1.0080	.2520
Do	4	6	2	.5096	.1274
Do	4	6	2	.7384	.1846
Do	4	6	2	1.7584	.4396
Very tight	4	6	2	.0168	.0014
Do	4	6	2	.2800	.0700

The results ranged from a leakage of 0.0014 c. c. to one of 0.6174 c. c. of carbon monoxide per hour, the average being 0.3117 c. c. of carbon monoxide per hour. If it be remembered that these figures

are for tight connections, it can be imagined what the results might be for the ends of old tubing (see figs. 24 and 25) that had become spread with heat and with use.

TESTS OF PERMEABILITY OF PIECED CONNECTIONS.

In addition to tests of the permeability of gas connections, tests were made of the permeability of pieced connections (fig. 26), such as are often used in shops of the garment trades to eke out scanty lengths of tubing or to repair leaks. The results of these tests are set forth in the following table (Table 15):

TABLE 15.—*Permeability test on joints of pieced gas tubing used in shops of garment industry.*

	Number of hours of test.	Gas pressure in inches of water.	Cubic feet of gas per hour.	Carbon monoxide.	
				Total. (c. c.).	Per hour (c. c.).
Sample No. 1	2	2	6	1.5808	0.7909
Sample No. 2	2	2	6	.9536	.4768
Sample No. 3	2	2	6	1.6720	.8360

TESTS OF PIECES OF RUBBER TUBING CONNECTED BY METAL TUBE.

Specimens of jointed gas tubing made up of two pieces of rubber tubing connected by a short piece of metal tube were obtained from shops in the garment industry in which they were being used, by giving in exchange for them new pieces of tubing. The joints of these tubes were tested for permeability in the same way as the gas connection described above on page 39. The diffusion of carbon monoxide per hour ranged from 0.4768 to 0.8360 c. c. Even if the diffusion were much less, the continued motion, back and forth, of the gas iron is liable to strain and pull apart the jointed parts of the tube.

IV. HYGIENIC SIGNIFICANCE OF SMALL AMOUNTS OF CARBON MONOXIDE.

CARBON MONOXIDE POISONING.

PROPERTIES AND OCCURRENCE OF THE GAS.

Carbon monoxide is a colorless, odorless, and tasteless gas, practically insoluble in water, having a specific gravity (0.9673) slightly less than that of air. It burns with a blue flame and forms explosive mixtures with air or oxygen.

In addition to being present in illuminating gas, carbon monoxide is formed whenever any carbon containing material is burned in an incomplete supply of air. It is also formed in a large number of industrial processes, such as in steel making, in foundries, about limekilns and gas engines, in gas manufacture, and in mining. Carbon monoxide may find its way into the confined air of inhabited places through direct leakage from defective gas mains, pipes, and joints, through defective gas tubing and its connections, or from defective gas appliances, such as cooking stoves, hot-air heaters, so-called "instantaneous" hot-water heaters, and pressing irons. It has been repeatedly shown, where Bunsen burners are used for gas ranges or other appliances, that with increased pressure gas may escape through the air inlets of the burners. In the case of flaring gas flames some gas also escapes unconsumed.

Whenever gas flames come into contact with a cold object there is a possibility of imperfect combustion resulting in the formation of carbon monoxide gas. Thus Thorpe (64) has shown that an ordinary Bunsen burner heating a sand tray evolves about 0.022 cubic foot of carbon monoxide per hour. Hence, if a gas flame comes in contact with the cold surface of a cooking utensil, there arise conditions favoring the formation of carbon monoxide. Furthermore, when the soot which gradually collects around the coils of hot-water

heaters becomes incandescent, conditions become favorable for the formation of carbon monoxide.[1]

POISONOUS ACTION.

The poisonous action of carbon monoxide results, in the first place, from its power of combining with the hemoglobin of the red corpuscles of the blood to form a fairly stable compound, carbon monoxide hemoglobin, which interferes with the oxygen-carrying power of the hemoglobin and causes death by cutting off the oxygen supply to the tissues of the body; in the second place, it is said to have a direct effect upon the central nervous system, often a narcotic and depressing action, and may even produce paralysis.[2]

One of the serious features of carbon monoxide poisoning is that its action is insidious. Even very small amounts of the gas in the air will be taken up by the blood, thus proportionally diminishing its oxygen-carrying power. Carbon monoxide does its mischief secretly, so that it may take a long time before the gas accumulates in the blood in sufficient quantity to make its presence felt by

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[1] Rosenau (53) referred to a case in Washington where carbon monoxide from a water heater accumulated in a kitchenette to such an extent that three persons were overcome and death resulted. Glaister and Logan refer to a case reported by Ryberg (54) in which a fatal accident occurred due to the use of a badly constructed "geyser" or "instantaneous" heater for a bathroom. There was no chimney or pipe to carry away the combustion products and the small room was completely closed. One gas bracket was still lit, but the heater was extinguished. The victim was found dead in the bath, with her mouth under the water. There was no odor of gas, and examination of the blood showed the presence of a large amount of carbon monoxide. The heater being suspected as the cause of poisoning, it was lighted and kept burning for 19 minutes in the closed room, after which an analysis of the air showed 2.5 per cent carbon dioxide, 13.9 per cent oxygen, and 1 per cent carbon monoxide. The production of carbon monoxide increased with the consumption of oxygen. Thompson (63) mentions that out of 90 cases of acute illuminating gas poisoning which occurred in the course of his hospital service in New York, 18.8 per cent were fatal, and of these many were due to the careless use of gas stoves.

[2] In this connection Kobert (28) states: "That carbon monoxide has a direct action on the nervous system is shown in a marked manner when an atmosphere of oxygen with at least 20 per cent of carbon monoxide is breathed; for in the first minute there is acute cramp or total paralysis of the limbs, when the blood in no way attains the saturation sufficiently great to account for such symptoms. Geppert has, through special research, shown that an animal suffocated by withdrawal of oxygen increases the number and depth of the respirations; but when the animal is submitted to carbon monoxide, in which case there is quite as much a widthdrawal of oxygen as in the former case, yet the animal is not in condition to strengthen its respiratory movements; Geppert rightly concludes that carbon monoxide must have a primary specific injurious action on the nerve centers. I (Kobert) am inclined to go a step further, and, on the ground of unpublished researches, to maintain that carbon monoxide not only affects injuriously the ganglion cells of the brain, but also the peripheral nerves (e. g., the phrenic), as well as various other tissues, as muscles and glands, and that it causes so rapidly such a high degree of degeneration as not to be explained through simple slow suffocation; even gangrene may be caused." Thompson (63) found that the effects of carbon monoxide on the nervous system were evident in cases where there were present a large percentage of red cells carrying oxygen. This condition has been known to persist long after the carbon monoxide has left the blood. According to Glaister and Logan (19), in many cases nervous lesions developed after repeated exposure to small quantities of carbon monoxide.

symptoms of illness. While the odor of illuminating gas which contains the odorless carbon monoxide will often give warning of the presence of a poisonous atmosphere, people often do not perceive an odor either because of its gradual development or because of colds or nasal catarrh. Fatal accidents have been known to occur when gas, leaking from a main, traveled through the soil, thereby losing its characteristic odor, and entered houses some distance from the break in the main, fatal poisoning being caused without persons in the building being warned by any odor of gas.

The affinity of hemoglobin of the blood for carbon monoxide is about 200 times greater than that for oxygen, so that, although there may be only a very small amount of carbon monoxide present in the air respired, the action of the gas is cumulative and up to certain limits the carbon monoxide is gradually but continuously taken up by the hemoglobin. When the blood has absorbed carbon monoxide to the extent of 20 per cent symptoms appear, though only on exertion, and consist of headache, slight giddiness, shortness of breath. Decided symptoms of poisoning are evident when the hemoglobin is about one-third saturated with carbon monoxide, and death occurs when it is over 60 per cent saturated. In investigating the relation existing between the time required to produce toxic symptoms and the carbon monoxide in a given atmosphere, Haldane found that the time required for a given amount of carbon monoxide in the air to produce toxic symptoms depended on the time required for producing a given degree of saturation of the hemoglobin of the blood. The human body has about 5 liters of blood, the red cells of which are capable of taking up 1 liter of carbon monoxide. To attain a one-third saturation of the blood would, therefore, require the inhalation of one-third of a liter of carbon monoxide, or 333 c. c. Since in normal respiration 7 liters of air are inhaled in a minute, if the contaminated air contained 0.1 per cent carbon monoxide, there would be inhaled in a minute 7 c. c. of carbon monoxide. To attain a carbon monoxide saturation of the blood to the extent of one-third, or to inhale 333 c. c. would, therefore, require about 47 minutes, or three-fourths of an hour.

If after exposure to carbon monoxide an animal, while alive, is taken into the fresh air, especially into oxygen, at an increased tension, the carbon monoxide is gradually eliminated from the blood. The elimination of carbon monoxide takes place through a process of dissociation of the carbon monoxyhemoglobin and by exhalation of the liberated gas through the lungs. Whereas the time required to produce carbon monoxide poisoning depends upon the rate of absorption of carbon monoxide by the hemoglobin of the blood, the time required to produce recovery from carbon monoxide poisoning, so far as elimination of the poisonous gas from the blood is concerned,

depends on the rate of dissociation of the carbon monoxide hemoglobin and the subsequent elimination of the carbon monoxide. Observers differ as to the length of time required to free the blood from carbon monoxide after exposure to this poison. According to Pouchet (43) the carbon monoxide in the blood of surviving persons could be detected as long as 60 hours after exposure to gas, whereas Koch (29) found it within 10 hours and Hofman (26) only within 2 hours. In this connection, as the result of investigation on animals, Wechse (65) concluded that the longer the period of exposure to carbon monoxide the longer was the period of time in which the gas could be shown present in the blood. He pointed out, however, that the individual peculiarities of animals are also a factor to be considered.

SYMPTOMS OF ACUTE CARBON MONOXIDE POISONING.

Where the persons are exposed to large amounts of carbon monoxide, among the symptoms of acute poisoning may be headache, ringing in the ears, throbbing of the temples, disturbances of vision, giddiness, especially after exertion, powerlessness of the lower extremities from a feeling of weakness and staggering up to complete paralysis, vomiting, marked shivering, chilly feelings and inability to keep warm, cutaneous eruptions, palpitation of the heart, breathlessness, oppression about the chest, tachycardia (greatly increased pulse rate), bradycardia (decreased pulse rate), vasomotor disturbances, such as flushing sensations of heat over the face, head, and neck followed usually by cold sweats, edema, albuminuria, glycosuria, loss of sensation in the hands or feet, derangements of the nervous system, such as weakening of memory, sight, hearing, disturbances of speech, neuritis, and in some cases even convulsions and severe inflammations of the upper air passages, as bronchitis and laryngitis.

CHRONIC CARBON MONOXIDE POISONING.

Chronic carbon monoxide poisoning, arising from continued breathing of small amounts of carbon monoxide, starts usually with symptoms similar to those of acute carbon monoxide poisoning, but differing in degree. Among some of the symptoms characterizing this slow and gradual poisoning are headache, pallor, progressive anemia, derangements of the digestive system, a slow pulse, mental dullness, fatigue after but little exertion, failing memory, palpitation of the heart, and a tendency toward difficulty in breathing.

CARBON MONOXIDE EXPERIMENTS.

ON ANIMALS.

Experiments on rabbits have shown that when an admixture of 5 per cent of carbon monoxide is added to ordinary air the animals quickly succumb, and die in convulsions within 10 minutes (Eulenberg). With an air mixture containing 3 per cent of carbon monoxide death sets in in about 20 minutes (idem). For rabbits the lowest fatal carbon monoxide atmosphere is in the neighborhood of 0.5 per cent. Gruber reports that deaths followed in rabbits on exposure to carbon monoxide concentrations of 0.4 per cent or more, though mixtures between 0.2 per cent and 0.4 per cent could be endured, with severe symptoms of stupor, for many hours. Mixtures containing from 0.1 to 0.2 per cent carbon monoxide soon produce, according to Gruber, dyspnea, uncertainty of movements, and disturbances of equilibrium, and yet this condition was endured for 10 hours without any increase in severity. The lowest amounts of carbon monoxide that were just sufficient to produce perceptible effects appeared to be from 0.07 to 0.08 per cent. With this carbon monoxide mixture Gruber observed in the animals an acceleration and shallowness of the respiration and general fatigue. This investigator also reported the case of a pregnant rabbit that breathed a mixture of from 0.044 to 0.059 per cent of carbon monoxide for 66 hours without the slightest apparent effect upon its health. Nowicki (39) found the lowest limit which produced symptoms of weakness in rabbits to be about 0.25 per cent.

CARBON MONOXIDE EXPERIMENTS ON MAN.

Experiments on the effect of various amounts of carbon monoxide on man are not as numerous as they might be. After breathing mixtures of carbon monoxide containing 0.021 and 0.024 per cent on two successive days for periods of three hours without experiencing either discomfort or ill effects, Gruber (21) concluded that at high dilutions carbon monoxide is harmless.

Fokker (17) in criticizing Gruber's experiments and conclusions maintained that prolonged breathing of the small amounts of carbon monoxide present in overheated rooms filled with tobacco smoke is one of the principal causes of the paleness and undernourishment of people leading sedentary lives and that it is erroneous to consider of hygienic importance only those amounts of carbon monoxide that produce visibly toxic effects.

Mosso (37) reported the results of his experiments on three men. In one case where the subject breathed from 0.02 to 0.05 per cent of carbon monoxide for 60 minutes, there were no observable ill effects.

Breathing 0.10 per cent carbon monoxide for 15 minutes somewhat retarded the respiration and accelerated the pulse. In an experiment of 30 minutes' duration, in the last 15 minutes of which the atmosphere contained 0.35 per cent carbon monoxide, there were no observable symptoms. After 55 minutes' exposure to 0.37 per cent carbon monoxide the subject felt a knocking in the temples and had vertigo and nausea. The same person during an experiment lasting 100 minutes, the last 22 minutes of which he breathed 0.43 per cent carbon monoxide, had no symptoms. In another experiment the same carbon monoxide content (0.43 per cent) was reached in 17 minutes, and produced, 12 minutes later, vertigo as the first symptom of poisoning. Fourteen minutes later, or 26 minutes after enduring a carbon monoxide content of 0.43 per cent, respiration was impeded and symptoms endangering life set in, so that the experiment was discontinued and artificial respiration with oxygen had to be used.

Another subject who breathed 0.3 per cent carbon monoxide for 50 minutes and 0.4 per cent for 40 minutes was affected in both instances by headache, vertigo, and vomiting. A third subject who inhaled 0.4 per cent carbon monoxide was more susceptible. After 25 minutes he had extreme difficulty in breathing, vertigo, and nausea. Mosso called attention to the similarity between carbon monoxide intoxication and illness caused by presence in a rarified atmosphere.

Burrell (4 and 5) exposed himself to an atmosphere containing 0.25 per cent of carbon monoxide for 20 minutes. He then had a slight headache. About an hour after the conclusion of the experiment he ate a light meal. About 15 minutes after eating he rapidly became ill. His headache increased. This was followed by nausea and severe vomiting. Retching was present long after the contents of the stomach had been expelled. He now suffered from violent headache. Recovery was not complete until 10 hours had passed. On another occasion Burrell breathed a similar atmosphere of carbon monoxide for 8 minutes without experiencing noticeable effects.[1]

Haldane (23) made a number of experiments upon himself, breathing definite mixtures of carbon monoxide and air for different periods of time. The carbon monoxide content of the blood was determined and observations were made of the effects produced on himself. Breathing a 0.5 per cent carbon monoxide atmosphere for 11½ minutes produced hyperpnea (abnormally active breathing). Inhalation of 0.39 per cent carbon monoxide for about 30 minutes was followed

[1] The additional details of these experiments, not given by Burrell in Technical Paper No. 11 of the United States Bureau of Mines, 1912, were obtained personally from this investigator.

by dizziness, palpitation of the heart, and difficulties in vision and respiration. A blood test showed 39 per cent of the hemoglobin to be saturated with carbon monoxide. Inhalation of 0.40 per cent of carbon monoxide for 24 minutes produced a 27 per cent saturation of the blood with this gas, and hyperpnea, together with slight giddiness after exertion. In one experiment he breathed for 29 minutes air containing 0.36 per cent of carbon monoxide. The symptoms were the same as those just above mentioned, together with a throbbing in the head and palpitation of the heart. A blood test showed 37 per cent of the hemoglobin saturated with carbon monoxide. An air mixture containing 0.12 per cent carbon monoxide breathed for 120 minutes produced a 37 per cent saturation of the hemoglobin with carbon monoxide, and was followed by the following symptoms: Hyperpnea, dull and "abnormal" feeling, and marked impairment of vision and hearing. Breathing an atmosphere containing 0.21 per cent carbon monoxide for 71½ minutes produced an exaggeration of the symptoms above mentioned and uncertainty of movements. The saturation of the hemoglobin with carbon monoxide amounted to 49 per cent. In one experiment Haldane breathed for 4 hours air which contained 0.045 per cent carbon monoxide. The symptoms were the usual hyperpnea, with slight palpitations. There was a 23 per cent saturation of the hemoglobin with carbon monoxide. An air mixture containing 0.027 per cent carbon monoxide (270 parts of carbon monoxide per million parts of air) was inhaled for 3½ hours. The hemoglobin was saturated with carbon monoxide to the extent of 14 per cent and no ill effects were observed, excepting a slight shortness of breath on exertion. Breathing 0.021 per cent carbon monoxide for 4 hours produced no noticeable symptoms. From the above it is seen that the smallest amount of carbon monoxide that produced noticeable effects on Haldane was 0.027 per cent, or 270 parts of carbon monoxide per million parts of air.

In considering what is the smallest amount of a poisonous gas which is injurious it should be remembered that it makes considerable difference whether the poisonous atmosphere is breathed occasionally for a comparatively short period of time, or whether the person is exposed regularly for fairly long periods of time, as is the case with a person working in an atmosphere where such poisonous gas is being constantly discharged into the air.

TOLERANCE TO CARBON MONOXIDE.

TOLERANCE IN ANIMALS.

With regard to the establishment of tolerance to carbon monoxide in animals the work of Nasmyth and Graham (38) is interesting. These investigators kept a number of guinea pigs in a gas chamber in an atmosphere of carbon monoxide sufficient to saturate 25 per cent of the hemoglobin of the blood. This treatment was continued daily for several weeks. As the animals were breathing an atmosphere in which they could use only 75 per cent of their hemoglobin for carrying oxygen to the tissues, it was thought that the health of the animals would be affected and that there would result a loss in weight and anemia. To the surprise of the investigators they found, on the contrary, that the animals were as lively as before and actually gained in weight. Examination of the blood at first showed degeneration of the red blood corpuscles. Normoblasts appeared as early as the third day, and the red blood corpuscles increased in number until a maximum was reached in three or four weeks. This increase in the number of blood corpuscles takes place to compensate for the loss in oxygen-carrying power of the blood. A similar compensation in the blood-forming organs occurs in high altitudes where the oxygen is rarer than at ordinary altitudes, and also after the body suffers a considerable loss of blood. Nasmyth and Graham then gradually increased the saturation of the hemoglobin with carbon monoxide until it was raised to 45 per cent. Exposure to these conditions made the animals ill and caused them to lose weight, but in four or five days they apparently recovered. Examination of the blood showed about the same phenomena as when the animals were first subjected to a carbon monoxide atmosphere. When normal guinea pigs were now exposed to an atmosphere sufficient to cause 45 per cent saturations of the hemoglobin with carbon monoxide, they would die in three or four days.

Oliver (40) has exposed dogs to 0.8 per cent of carbon monoxide in compressed air for several hours apparently without any bad effects.

In these experiments on the effect of different atmospheres of carbon monoxide, the action on the nervous system was not taken into consideration. It should also be remembered that because the animals tolerated given atmospheres of carbon monoxide for several weeks or months, it does not follow that they would not suffer in health when exposed to this atmosphere for much longer periods of time.

TOLERANCE IN MAN.

Susceptibility to carbon monoxide poisoning varies greatly in different persons. Although no individuals are immune to carbon monoxide poisoning, still there are persons who seem able to endure for a while an atmosphere which would render those more susceptible unconscious. Such so-called "gas-proof" men are sent out by some mining or other companies to attend to leaks or other accidents involving exposure to gas. Individual susceptibility or idiosyncrasy seems to be a very important factor in gas poisoning, as cases are recorded where only very short exposures to small amounts of carbon monoxide have proved fatal. There are also cases on record where persons who were seriously poisoned recovered rapidly, while others who at the time of exposure showed no serious symptoms of poisoning later developed serious aftereffects. Toleration to minute amounts of carbon monoxide may be established in some individuals, who will be able to remain at work in atmospheres which at first affected them sufficiently to produce symptoms of gas poisoning. On the other hand, there are persons in whom it seems toleration can not be established, and they soon get headaches, become anemic, suffer from palpitation of the heart and breathlessness, and display other symptoms of gas poisoning just so long as they continue to work in atmospheres containing some carbon monoxide.

In addition to individual susceptibility or idiosyncrasy the following factors are involved in the establishment of toleration to carbon monoxide poisoning: The length of exposure, the percentage of carbon monoxide gas present, increase in the amount of carbon dioxide or decrease in the amount of oxygen in the air, the age of the individual, the constitution, the depth of chest movements, amount of muscular exertion, the volume per minute of the circulation, addiction to alcohol, the sex, and the condition of health. Mention has already been made of the relation between the concentration of carbon monoxide and the time required to produce poisoning.

An abnormal increase in the amount of atmospheric carbon dioxide or abnormal decrease in the amount of atmospheric oxygen will render the individual more readily susceptible to carbon monoxide poisoning. So far as age is concerned susceptibility seems higher in the very young and the aged. As a rule, those with stronger physiques can withstand carbon monoxide poisoning better than those not so well built. Strong young men, however, are more easily affected by carbon monoxide than older men, as their activity is greater, and the volume of the circulation per minute consequently higher. This favors the more rapid absorption of a

larger quantity of the poison. In people of any age those exerting themselves most are the first to be overcome. Not only will increased muscular activity hasten the effect of carbon monoxide poisoning, but marked mental effort or mental distress, as anxiety or worry, will do so even quicker.[1]

The volume of the circulation per minute and perhaps, as Glaister and Logan suggest, the amount and the quality of hemoglobin are also factors to be considered in the matter of susceptibility to carbon monoxide poisoning.

According to Glaister and Logan, women do not stand chronic poisoning by small amounts of carbon monoxide as well as men, and it is they who are more subject to nervous aftereffects of the gas. In factories or shops into which carbon monoxide has penetrated, women seem to be the first to be affected. A factor in producing susceptibility to poisoning which, in the case of women, is usually negligible, is addiction to alcohol. Persons addicted to alcohol can not stand a carbon monoxide atmosphere as well as those who abstain from the use of alcohol.

Diseased conditions of the body, such as weakness of the nervous system, especially of the heart or lungs, generally renders the individual more susceptible to carbon monoxide poisoning. Since a person having a lesion of the lungs has only a part of his lungs available to get oxygen, and since under these conditions there is less hemoglobin available for carrying oxygen to the tissues, the person becomes more easily subject to the influence of carbon monoxide poisoning. Glaister and Logan mention the case of a tuberculous patient with considerable consolidation of the right lung, who, after working for three or four weeks about a gas-engine plant, complained of symptoms which could be directly referred to carbon monoxide poisoning. Instead of becoming habituated to the carbon monoxide atmosphere as he had been assured, he was becoming so sick that he was compelled to give up his work. On starting to work in the open air he quickly improved in health.[2]

WORK OF PRESSER OR IRONER.

NUMBER OF PRESSERS AFFECTED.

From the figures for the number of wage earners in the garment industry, as given by the United States census of 1910, it is estimated that there are about 400,000 garment workers in the United States. If the proportion of pressers or ironers to garment workers throughout the industry is about the same as it is in the garment

[1] Glaister and Logan.

[2] See Appendix B for summary of a case of wholesale chronic carbon monoxide poisoning reported by Morel and Mouriquand (6, 7, 35, 36).

industry under the jurisdiction of the Joint Board of Sanitary Control of the Cloak, Suit, and Skirt and the Dress and Waist Industries of New York City, which included over 85,000 garment workers in 1911 (10 per cent), then the number of pressers or ironers in the garment industry in the United States is approximately 40,000. Forty thousand pressers, together with many thousands of other workers associated closely with them in their work, are therefore directly concerned with the conditions of sanitation and industrial hazards mentioned in this report.

NATURE OF PRESSER'S WORK.

The work of the presser consists in hand ironing or pressing garments. The irons are rather heavy, averaging about 16 pounds in weight, and some of them weigh from 20 to 25 pounds. Overheated irons are cooled by immersion of the pressing surface into pails of water, and the steam arising from this process and from pressing moistened garments, together with the heat of the iron itself, often produces atmospheric conditions which almost sicken the pressers.

Whereas the general workers in the same room with the pressers may not be affected as much by leakage from artificial illuminating gas because the products of incomplete combustion of gas irons or leakage from tubing and connections is spread gradually through the room, the presser in the course of his work bends down over the pressing iron, and if that appliance is defective, or if there is gas leakage from tubing or connections, he, working nearest to the sources of air contamination, will be the first to suffer.

Generally there is no special room occupied by the pressers, who do their work on tables placed where they do not interfere with the work of the machine operators or finishers, who need most of the light, and who, as a rule, are located near the windows. Most of the pressing is, therefore, done in the middle of the loft or in corners of the shop. In the desire of the shop managers to keep the irons as hot as possible, the pressers are sometimes kept still farther away from the needed fresh air and light by partitions surrounding the pressing table.

CARBON-MONOXIDE POISONING OF PRESSERS.

That pressers or ironers are subject to health hazards of poisoning by carbon monoxide has been recognized by a number of investigators.

Arlidge (1), writing in England in 1892 on diseases of occupations, in referring to the use of hollow pressing irons heated by a jet of gas which is led to the iron by flexible tubes, pointed out the danger to the pressers of working in an atmosphere containing escaped gas and unhealthy products of combustion. In a report on industrial poisons issued by the French Government (41) in 1901, mention is made of a chronic form of intoxication by carbon monoxide

among pressers using hollow irons heated by charcoal, which brings about a weakening of vision, frequent syncopes on working and weakness in the muscular movements. Epstein (12), referring to the high amount of carbon monoxide given off from charcoal gas irons, says that not only do the pressers suffer with headache and dullness and other symptoms characteristic of gas poisoning, but that tailors and seamstresses working in the vicinity are also affected. Rambousek (44) mentions a case of poisoning in a Berlin laundry where gas irons were heated by gas under pressure. The gas used was made from charcoal, and the gas jets were in stoves from which the fumes were exhausted mechanically. This arrangement, which was considered satisfactory, was used for months before the mechanical ventilation got out of order. When this happened, 12 women suffered so severely from symptoms of carbon monoxide poisoning that is was necessary to resort to artificial respiration with oxygen. Glaister and Logan (19) refer to cases of paralysis that developed among cooks, laundry workers, ironers, and others, in which the patients were never sufficiently affected as to be overcome to the extent of becoming unconscious. These authors also state that Régis (45) called attention to the fact that in the acute forms of carbon monoxide poisoning a very prominent symptom is retrograde amnesia, and observed rapid and incurable dementia follow in prolonged chronic poisoning in ironers whose previous symptoms included vertigo, mental dullness, and hallucinations. Simpson (58) reports the case of an ironer who was the subject of attacks of vertigo, headache, and visual hallucinations when she awoke in the morning. She always felt worse after "glossing" and during drying. Glaister and Logan state that Molliet (34) called attention to the "frequency with which feebleness of vision, generally produced by congestion of the choroid, was met with in ironers in laundries, and he further noticed that in these cases this affection took a long time to cure." Sachs (55) mentions that he found among laundresses cases of pronounced anemia, accompanied by digestive disturbances, headache, and palpitation of the heart. These troubles quickly disappeared when the patients discontinued their occupation, but reappeared on their resuming it. He also reported cases showing a striking resemblance to chlorosis and other cases so aggravated as to suggest pernicious anemia.

Glaister (19) in his evidence before the departmental committee on compensation for industrial diseases in England in 1907 said: "I have noticed fresh, healthy young girls go into a laundry, and within six months become absolutely bleached, colorless, anemic, useless, and get knocked off work, and unless they were sent away to the country were apt to break down in health." It is mentioned by Glaister and Logan that Lancereau and others in reporting serious cases of chronic carbon monoxide poisoning held that such occurrences in cooks and ironers who were exposed to this gas during this work were not infrequent.

OTHER HEALTH HAZARDS OF PRESSERS.

Exposure to gas poisoning from carbon monoxide is not the only health risk the presser has to stand. The constant standing, the lifting and handling of heavy irons, the stooping forward, the exposure to the high degree of humidity due to evaporation from the pressed moist garments, and also from the high temperature resulting from the heated irons and garments, all contribute to make the operation of pressing garments fatiguing.

Hayhurst (24) refers to the fatiguing character of hand pressing or ironing, as attested to by the number of persons with fatigue neuroses particularly affecting the arms used who appear at dispensaries and hospitals. He states that often there is, in addition to the above, neuritis and partial paralysis.

A man who is physically weak can not long stand the strain of working under these strenuous and insanitary conditions. The result is that for this kind of work weaklings are eliminated at the start. Few men will apply for this kind of work unless they have fairly robust constitutions. Schereschewsky (56) in his physical examination of the workers in the garment industry found that few females worked as pressers, that male pressers as a class had the most robust physiques and stolid temperaments, and that no less than 40 or 50 per cent of their previous occupations entailed considerable muscular exertion and, therefore, required a vigorous physique. In his comparative study of the condition of the blood among the various groups of workers in the garment industry, Schereschewsky (56) found that the small group of miscellaneous workers with 88.5 per cent hemoglobin in the blood (Tallquist scale used) had the highest percentage of hemoglobin, while pressers were next with an average of 87 per cent, and then, in the following order, came operators with 86.8 per cent, cutters with 86.7 per cent, tailors with 86.2 per cent, and finishers with 86 per cent. Schereschewsky further states that, "although pressers had the highest average percentage of hemoglobin of the three large groups of workers, this group nevertheless furnished the worker in whom the lowest reading (65 per cent) found among males was recorded, and also had the greatest number of individuals (31 in 658 observations, or 4.7 per cent) in whom the hemoglobin was below 80, according to the Tallquist scale."

Examination of the air in the shops of the garment industry has shown that pressers are exposed to carbon monoxide poisoning from defective gas tubing, defective gas connections, and defective gas irons. That this is the case was also suggested by Rogers (51) in his report on Ventilation in the Cloak and Suit Industry. The present findings as to the danger of chronic carbon monoxide poisoning of pressers, therefore, is in accord with the results of the blood tests of pressers showing that the presence of carbon monoxide in the atmosphere of shops is a factor in producing the low hemoglobin in the blood of the pressers who work in closest proximity to the sources of air contamination from illuminating gas.

ELECTRICALLY HEATED PRESSING IRONS.

In view of the fact that electrically heated pressing irons remove all possibility of hazard to workers of poisoning by carbon monoxide gas, the adaptability of these irons for use in the garment trades should be considered. There are on the market electric irons that give thorough satisfaction. The safest thing for a prospective user of electric irons to do, however, is to consult the company furnishing him electric power with regard to the best appliances.

While a number of manufacturers of waists and dresses have adopted the use of electrically heated pressing irons, there seems to be an impression in the clothing trade that these irons are unsuitable for pressing heavy garments, because of being too light. This is an erroneous impression, for manufacturers of electric irons have made them sufficiently heavy to press cloaks, suits, and other heavy garments or material. (See fig. 27.)

Electric pressing irons are superior to gas-heated pressing irons in the following respects:

(1) As a result of the greater control of the proper temperature with the use of electric irons there is no overheating of the working room in the hot summer weather with the resulting discomfort and tired and depressed feeling incidental to working near overheated gas pressing appliances.

(2) In the case of electrically heated pressing irons, as no gas is used, it is impossible to have any harmful effects due to the escape into the working room of poisonous illuminating gas or any products of its incomplete combustion.

(3) Boards of fire underwriters often give lower insurance rates to users of electrically heated appliances than to users of gas-heated appliances.

SUMMARY.

The present investigation as to the hygienic conditions surrounding the use of gas-heated irons and accompanying appliances is part of an investigation of the health of garment workers undertaken by the Public Health Service at the request and with the cooperation of the Joint Board of Sanitary Control of the Cloak, Suit, and Skirt, and Dress and Waist Industries of New York City.

The investigation embraced—

(1) Air tests in shops of the garment industry with reference to the amount of carbon monoxide gas present and studies of the condition of gas-heated appliances in these shops.

(2) Laboratory tests of the gaseous combustion products of various kinds of gas-heated pressing irons.

FIG. 27.—ELECTRIC IRONS USED IN SHOPS OF THE GARMENT INDUSTRY IN NEW YORK CITY.

(3) Permeability tests of various kinds of flexible gas tubing used for conveying gas to the pressing irons, and of the gas connections between the gas tubing and the gas iron.

(4) The hygienic significance of the presence of small amounts of carbon monoxide in the air of confined inhabited places.

I. EXAMINATION OF AIR AND OF GAS APPLIANCES IN SHOPS.

Air samples.—Samples of air for analysis were secured from 244 shops. In 29 shops, or 11.8 per cent, the amount of carbon monoxide present in samples taken near gas-heated pressing irons was over 100 parts in a million parts of air, the average for these shops being 325 parts of carbon monoxide per million parts of air. The amounts actually present ranged from a minimum of 105 parts to a maximum of 1,431 parts of carbon monoxide. The contamination of air samples taken near windows, at points removed as far as possible from sources of contamination, was very much lower, the amounts of carbon-monoxide gas present ranging from a minimum of 2.4 to a maximum of 39.6 parts to the million of air. The average carbon-monoxide content for these 29 shops was 11.8 parts to a million parts of air.

The average amount of carbon monoxide present for the entire number of shops (244) was 55.4 parts for samples taken near pressing irons and 7.4 parts in the million parts of air for window samples.[1]

Gas odor.—An odor of gas was perceptible in 93 establishments, or 38 per cent of the total number inspected. In 29 shops where carbon monoxide was present in excess of 100 parts per million of air, a gas odor was noticeable in 27, or 93 per cent. Out of 55 shops having carbon monoxide present in amounts ranging from 25 to 100 parts to the million of air, a gas odor was noticeable in 40 instances, or in over 72 per cent of the total.

Ventilation.—No mechanical system of ventilation was used in any of the shops visited, natural ventilation through windows being relied upon. Electric fans were provided in only 6 per cent of the shops inspected. Of these, less than one-half used the fans. While windows were generally kept open during the warm weather, during the cold season almost all the windows were kept shut.

Gas tubing and gas-tubing connections.—In connection with gas-heated pressing irons, rubber tubing was used in 77 per cent of the shops inspected, while flexible metal tubing was used exclusively in 9 per cent. About 11 per cent use both rubber and flexible-metal

[1] In considering the results of these air tests, it should be remembered that the investigation was carried on in the open-window season. The supposition is reasonable that in the winter time, with closed windows, the conditions would be considerably worse.

tubing. Flexible-metal tubing, therefore, was used in about 20 per cent of the shops. Flexible-metal tubing was used in connection with "blower" irons in about 16 per cent of the shops.

Defective rubber tubing was found in use in 52 shops of the 244 inspected, or in 21.3 per cent of the total. Defective flexible metal tubing was found in 16 shops, or 6.5 per cent of the entire number examined. Both defective rubber and flexible metal tubing were found in 66 shops, or in 27 per cent of the total number, i. e., 1 out of less than 4 shops was using some kind of defective gas tubing.

Poor gas-tubing connections were found in 17 cases, or in about 7 per cent of the total number of shops inspected.

Gas irons.—Of the 244 shops inspected, 122, or 50 per cent, used ordinary gas irons only; 102 shops, or 41.8 per cent, used "blower" irons exclusively, i. e., irons heated by means of a mixture of gas and air under pressure; 6 shops, or 2.4 per cent, used electric irons only, while the remainder used miscellaneous irons. Defective gas irons were found in 21 shops, or 8.6 per cent of the total number.

Reinspections.—That the occurrence of abnormal amounts of carbon monoxide in the air of workshops was not fortuitous was shown by the results of reinspections. Of 10 shops in which the carbon monoxide at the first inspection was over 100 parts per million parts of air, 5 shops on reinspection still gave over 100 parts of carbon monoxide to the million. Of these 5 cases, 2 were found in which the carbon monoxide present on reinspection was more than twice as high as at the original inspection.

II. COMBUSTION PRODUCTS OF GAS-HEATED PRESSING IRONS.

Examination of the combustion products given off from ordinary gas-heated irons showed that the percentage of carbon monoxide (as determined by the cuprous chloride method) varied from 0 (in an improved type of atmospheric iron) to 2 per cent. The limit of sensitiveness of the method used for determination, however, was 0.1 per cent; anything less than 0.1 per cent was therefore reported as 0. The average amount of carbon monoxide found in the combustion products of 8 different makes of atmospheric gas irons in 48 tests was 0.57 per cent, and the average for each make of iron ranged from 0 to 1 per cent of carbon monoxide.

In the case of "blower" irons, analyses of the combustion products by the cuprous chloride method showed no carbon monoxide. Twenty tests were made on four different makes of blower irons. By using the more sensitive iodine-pentoxide method, however, small amounts of carbon monoxide were found in the combustion products of blower irons (48 and 64 parts per million parts of air) as well as in the combustion products of an improved type of atmospheric iron

(72 and 90 parts per million parts of air) which showed no carbon monoxide with the cuprous-chloride method. In these cases the amounts of carbon monoxide present were probably insufficient to produce symptoms of chronic poisoning.

III. PERMEABILITY TESTS OF GAS TUBING AND GAS CONNECTIONS.

Sixty-eight tests were made on the permeability to illuminating gas of 16 different kinds of gas tubing.

The results of these tests show (1) that none of the gas tubes tested was found to be gas tight; (2) that the walls of tubing through which illuminating gas had been passed before making a test are more permeable to the gas than in the case of brand-new tubing; (3) that rubber tubing is the least permeable to gas; and (4) that flexible metal tubing and "composition" tubing give considerable leakages of illuminating gas.

Rubber tubing.—Examination of new rubber tubing showed that no rubber tubing such as is used in connection with pressing irons in the garment industry is gas tight. The smallest diffusion was 0.0009 c. c. of carbon monoxide per foot of tubing per hour; the largest diffusion 0.0564 c. c. It was shown that, other things being equal, a decrease in the thickness of the wall of the tube accompanies an increase in permeability of the tube to gas.

The passage of gas through the tubes before testing for permeability resulted in increasing the amount of gas diffusing through the walls of the tube. Tests made on new rubber tubing so treated showed an increase in the permeability of the tubing from 23 to 33 times the original permeability.

Tests made on old rubber tubing which had been used in shops gave permeability results ranging from 40 to 320 times the permeability of new tubing of equivalent quality.

Flexible metal tubing.—Permeability tests on flexible metal tubing showed that new flexible metal tubing permits more gas to be diffused through its walls than new rubber tubing, and that flexible tubing through which gas was passed for 30 days (240 hours) before the test leaks considerably more than new rubber tubing similarly treated. Tests on samples of old flexible tubing which were being used in the garment industry and which appeared to be in good condition showed that such tubing leaked enormously.

"Composition" tubing.—Tests made on brand-new "composition" tubing in one case gave a permeability result (0.0014 c. c. of carbon monoxide per foot of tubing per hour) comparable to that of new rubber tubing and in the case of a similar tube, but with an outer cover of asbestos, a diffusion (0.168 c. c. of carbon monoxide per

foot of tubing per hour) was obtained which was 120 times greater than the result above mentioned.

Permeability tests made on these tubes of composition material, after passing illuminating gas through them for 60 hours, showed a great increase in the diffiusion through the walls of the tubes. Compared to the first of the tubes above mentioned, the diffusion here was 113 times greater, and compared to the second tube above mentioned, it was 50 per cent greater.

Permeability tests of gas connections.—Permeability tests were made on connections between rubber tubing and metal tubes, such as are used for leading the gas into a gas iron. The results of these tests on gas connections ranged from a leakage of 0.0014 c. c. to one of 0.6174 c. c. of carbon monoxide per hour, the average being 0.3117 c. c. of carbon monixide per hour.

Jointed rubber tubing.—Specimens of jointed gas tubing made up of two pieces of rubber tubing connected by a short piece of metal tube were obtained from shops in which they were being used. Permeability tests on the joints of these tubes showed diffusions of carbon monoxide ranging from 0.4768 c. c. to 0.8360 c. c. per hour.

IV. HYGIENIC SIGNIFICANCE OF SMALL AMOUNTS OF CARBON MONOXIDE.

The quantities of carbon monoxide found in some of the shops studied in this investigation are sufficient to produce symptoms of chronic poisoning in pressers, for it has been shown that in some instances the amount of this gas present in the vicinity of pressing irons was over 1.4 parts per thousand parts of air.

It has been further pointed out in the course of the report that, even when the amounts of carbon monoxide present in the air are insufficient to produce visible symptoms of illness, nevertheless the injurious effect of the poison continues, as it puts out of action many of the oxygen-carrying blood cells, thus depriving tissues of their needed sustenance and undermining the nervous centers because of oxygen starvation. Continued exposure to these small amounts of carbon monoxide in time lowers the vital resistance of the body, thus inviting the onslaught of disease.

CONCLUSIONS.

1. The sources of the undue amounts of carbon monoxide found in the air of workshops are: (*a*) Incomplete combustion of illuminating gas in pressing irons; (*b*) leakage through the walls of hose used to convey gas; (*c*) leakage through defective connections to gas irons and gas pipes.

2. In addition to leakage caused by structural defects atmospheric gas-heated pressing irons may contaminate the air (*a*) by the partial

clogging of one or more openings in the gas burner by pieces of material rubbed off from the end of the tube conveying gas to the iron; (*b*) by "flashing back" of the burner flames.

3. While combustion is much better in blower than in atmospheric irons, the former have the following objectionable features: (*a*) Faulty connections permit the escape of gas; (*b*) the mixture of gas and air is not always easy to regulate; (*c*) the irons are noisy.

4. The use of electrically heated pressing irons removes the danger of exposure to carbon monoxide gas poisoning.

5. The walls of tubing used for conveying illuminating gas are not completely gas-tight.

6. Rubber tubing is the least permeable to illuminating gas.

7. Flexible metal tubing and cheap "composition" tubing are unsuitable for conveying a gas so poisonous as artificial illuminating gas.

8. The use of jointed or pieced rubber tubing is unsafe because of frequent looseness of the connection.

9. The rubber ends used to make connections in gas tubing are a more important source of gas leakage than the ordinary defective gas tubing.

10. The use of gas-tight metallic hose couplings for gas appliances is necessary in order to prevent gas leakage from hose connections.

11. The conclusion is justifiable that garment workers are liable to chronic poisoning by carbon monoxide gas.

12. Pressers are the class of garment workers the most exposed to the hazards of chronic poisoning from carbon monoxide.

13. A system of regular inspection and maintenance is necessary in order to insure proper hygienic conditions in the use of gas-heated appliances in workrooms.

14. Standards enforced by regulation are necessary for the construction of gas fixtures and gas-heated appliances, so that intrinsically defective gas appliances may not be used in the transmission of gas.

15. Education of workers in the use of safety precautions is necessary, so that they may avoid the danger of gas poisoning and exposure to air impurities. Particular emphasis should be laid on the means of securing proper ventilation in living and work rooms, and attention should be called to the fact that it is far better to remove than to minimize a health hazard.

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APPENDIX A.

HISTORICAL REVIEW OF METHODS FOR THE DETERMINATION OF CARBON MONOXIDE BY MEANS OF IODINE PENTOXIDE.

Ditte.—In 1870 Ditte (4)[1] observed that when iodine pentoxide is heated to a temperature of 150 to 200° C., it is decomposed as follows:

$$I_2O_5+5CO=I_2+5CO_2.$$

De La Harpe and Reverdin.—De La Harpe and Reverdin in 1888 (23) used this observation as the basis for a qualitative method for detecting carbon monoxide. First they passed the air through a glass wool, or cotton filter, then over pure iodic acid warmed to 150° C. in an oil bath, and finally into a solution of starch in distilled water. They called attention to the necessity of removing and excluding reducing agents. They stated that, with 9 liters of air containing from 1 to 2 parts of carbon monoxide in 100,000 parts of air, they obtained in about 20 minutes a very sensitive coloration.

Hélier.—Hélier in 1896 (19) in a thesis developed under the direction of Gautier applied this reaction quantitatively. Hélier passed the gas under examination first into a U tube containing glass beads saturated with iodine bromide to hold back ethylene, then into a U tube containing ammoniacal silver nitrate to hold back acetylene, after that into U tubes containing glass beads saturated with potassium hydroxide, and finally through sulphuric acid.

When the gas freed from interfering substances was passed at 60 to 65° C. into a U tube containing pieces of asbestos mixed with iodine pentoxide, only the carbon monoxide was oxidized, and this was received into a tube prepared according to the procedure of Muntz (32), who collected the carbon dioxide formed in a solution of potassium hydroxide, liberated the carbon dioxide with sulphuric acid, and then measured the volume of carbon dioxide over mercury. Gautier, by using the observations of Hélier, was able to determine 1 part of carbon monoxide in 10,000 parts of air.

Nicloux.—In 1898 Nicloux (34), unacquainted with the work of Hélier and Gautier, published an article in which he believed there was described for the first time the use of iodine pentoxide for the

[1] Bibliography follows article.

quantitative determination of carbon monoxide. Later he learned that Gautier had previously applied this method quantitatively.

Nicloux used iodine pentoxide at a temperature of 150° C. to oxidize the carbon monoxide and determined the amount of carbon monoxide by the depth of color that the liberated iodine gave with chloroform, or with carbon-disulphide solution, as compared to the depth of color obtained in standard tubes of iodine in chloroform solution. He purified his gas mixture by passing it over caustic potash to remove carbon dioxide, hydrogen sulphide, and sulphur dioxide, next over sulphuric acid to remove the moisture, and caught the iodine liberated from the iodine pentoxide in a solution of sodium hydroxide. He then liberated the absorbed iodine by treating the alkaline solution with sulphuric acid and sodium nitrite. By this method Nicloux was able to determine carbon monoxide in air in proportions of $\frac{1}{1000}$ to $\frac{1}{50000}$.

Gœutier.—Gautier (7) in the same year referred to the fact that he first estimated carbon monoxide from the increased weight of copper filings over which he allowed the liberated iodine to pass, but later preferred to estimate the carbon dioxide which formed according to the procedure of Muntz previously referred to. Gautier criticized Nicloux's colorimetric estimation of iodine on the ground that the reduction of iodates by nitrous acid in presence of sulphuric acid is not instantaneous in the cold and is not reliable with certain dilutions of nitrous acid.

In a later article Gautier (8) stated that he tried the determination of small amounts of carbon monoxide by absorption with cuprous chloride, ammoniacal silver nitrate, gold chloride, and also by oxidation with potassium permanganate, chromic oxide, damp silver oxide, and mercuric oxide, but the results were unsatisfactory. He suggested absorbing the carbon monoxide formed in the reaction with titrated barium hydroxide solution and estimating the carbon monoxide from the amount of carbon dioxide.

Gautier (9) in the same year published another paper reporting that the iodine-pentoxide reaction started before 30°, that it was active at 40 to 45°, and was complete at 60 to 65°. As to interfering substances, he found that acetylene was already oxidized at the expense of the iodine pentoxide at 35°, no matter what the dilution of the carbon monoxide with the air might be, that ethylene was oxidized at 65°, even if diluted with air, while hydrogen, methane, ethane, and, in general, hydrocarbons of the same series were not oxidized at 60 to 80° by iodine pentoxide. However, in determining the amount of carbon monoxide present in city air, he stated that the amount of unsaturated hydrocarbons ordinarily present does not sensibly affect the determination. In additional communications Gautier (10 and 11) described some modifications of his

method. He recommended heating the iodine pentoxide before use in a dry current of air at 220°. He then filtered his air through glass wool, passed it successively through caustic potash solution, a solution of barium hydroxide, anhydrous phosphorus pentoxide, then over straight tubes of iodine pentoxide and reduced copper powder. Both of these tubes were heated in an oven at 100° C.

Smits, Raken, and Terwogt.—In 1900 Smits, Raken, and Terwogt (41) proposed the use of iodine pentoxide for the volumetric determination of carbon monoxide in illuminating gas. They filled a tube similar to a Hempel palladium pipette with alternate layers of iodine pentoxide and asbestos. After removing from the gas the carbon dioxide, illuminants, and oxygen in the usual way, using the Hempel apparatus, they passed the residual gas into the iodine pentoxide tube heated to 150° to 180° C., allowed the iodine to sublime within the tube and then determined the carbon monoxide present, from the contraction in the volume of gas after the carbon dioxide formed in the reaction was absorbed in the caustic potash pipette. They obtained satisfactory results that agreed within 0.1 per cent, using a mixture of 8 c. c. of carbon monoxide and 42.8 c c.. of methane, and with another mixture of 8.8 c. c. of carbon monoxide and 72.6 c. c. of hydrogen.

Kinnicutt and Sanford.—In the same year Kinnicutt and Sanford (22) reported that they could not make accurate determinations of small amounts of carbon monoxide by either of the methods of Nicloux or Gautier, but obtained satisfactory results by determining the iodine set free after absorption with potassium iodide solution by titration with a N/1000 solution of sodium thiosulphate. Contrary to Gautier's experience they found that the reaction with iodine pentoxide was not quantitative below 150°.

To remove unsaturated hydrocarbons, hydrogen sulphide, sulphur dioxide, and similar reducing gases, they first passed the sample through two U tubes, one containing sulphuric acid and the other small pieces of caustic potash. The air in the sample bottle was displaced by mercury and was then passed through the tube at the rate of about 1 liter in two hours. The authors found the method capable of determining as little as 0.0025 per cent volume of carbon monoxide or 25 parts of carbon monoxide per million parts of air, using a 1-liter sample.

On analyzing air mixed with illuminating gas they found that unsaturated hydrocarbons, hydrogen sulphide, and sulphur dioxide in much larger quantities than are contained in illuminating gas or formed by its combustion, were perfectly absorbed when passed through the U tubes mentioned. Hydrogen and methane had no effect on the iodine pentoxide at 150° C.

Fillunger.—In determining the carbon monoxide present in mine air, Fillunger (5) in 1903 stated that he used the method of Moltersky and Nowicki.[1] The air sample, freed from carbon dioxide and moisture by passage over barium hydroxide and soda lime, was passed over iodine pentoxide at 120° to 150° C. The liberated iodine was retained by passing it over silver, and the carbon dioxide formed in the reaction was absorbed with an excess of standard barium hydroxide solution. A gas mixture of carbon monoxide and air gave 1.043 per cent carbon monoxide, whereas combustion with copper oxide gave 1.053 per cent. Their results agreed within from 0.01 to 0.1 per cent of the theoretical values.

Thorpe.—In the same year Thorpe (43) studied the possibility of air contamination by carbon monoxide as a product of combustion by the Bunsen burner. He reported good results with the iodine pentoxide method, using as little as 0.0025 per cent of carbon monoxide.

Lévy and Pecoul.—In 1905 Lévy and Pecoul (25) used Nicloux's method for determining the amount of carbon monoxide from the intensity in color imparted to iodine by a solvent, but instead of absorbing the iodine in carbon disulphide they used chloroform. They heated the iodine pentoxide to 80° C., as indicated by Gautier. Using this method with a sample of 4 liters of air, they were able to show the presence of 5 parts of carbon monoxide per million parts of air. In another communication the following year (26), they found that the presence of small amounts of acetylene does not seriously interfere with the method. One part of acetylene in 10,000 parts of air gave a faintly perceptible color which did not even correspond to that of 5 parts of carbon monoxide per million parts of air on their color scale. They therefore concluded that in examining air of cities for carbon monoxide the possible presence of acetylene as an interfering substance might be disregarded.

Gautier and Clausmann.—In 1906 Gautier and Clausmann (15) took up a study of the volumetric determination of carbon monoxide by means of cuprous chloride. They found that after absorbing the carbon monoxide by cuprous chloride in the usual way it was always possible to determine the carbon monoxide which was not acted upon by passing the residual gas over iodine pentoxide at 70° C. They also found that when carbon monoxide was diluted with an inert gas it did not burn completely when exploded with an excess of oxygen. They concluded that the iodine pentoxide method was the only one which gave correct results.

[1] This method is similar to that of Kinnicutt and Sanford, but instead of using the iodine liberated as a measure of the amount of carbon monoxide, they determined the carbon dioxide produced.

Nowicki.—Nowicki (35) in 1906 found that the decomposition of iodine pentoxide began at 165° C., and was complete at 300° C., while the oxidation of carbon monoxide began at 45° C., and the reaction was complete at 88° C. Acetylene acted but incompletely at 85° C., and was removable by concentrated sulphuric acid or copper sulphate solution acidulated with sulphuric acid. After passing through a purifying train of caustic potash solution and a drying tube of calcium chloride and soda lime, the gas was passed over a U tube containing the oxidizing agent heated in a paraffin bath at 120 to 125° C. One side of this U tube was filled with iodine pentoxide, the other with pieces of silver to retain the liberated iodine. The carbon dioxide liberated in the reaction was absorbed in an excess of barium hydroxide solution and titrated with standard oxalic acid solution. Results by this method for amounts of carbon monoxide varying from 0.01 per cent to 1.5 per cent gave differences of from 0.001 per cent to 0.007 per cent, as compared to results obtained by combustion over copper oxide.

Nowicki preferred benzol to carbon disulphide or to chloroform as a solvent for iodine for colorimetric determinations of carbon monoxide. He referred to the difficulty of getting good results with colorimetric methods and suggested the use of a colorimeter. Using arsenious acid to titrate the liberated iodine, in samples containing from 0.013 per cent to 0.052 per cent of carbon monoxide, he obtained results that agreed within 0.003 per cent of the theoretical values. Nowicki also determined carbon monoxide by measuring the electrical conductivity of a solution containing the carbon dioxide obtained from the oxidation of carbon monoxide, but found this method too complicated.

Toth.—Applying the iodine pentoxide method to the determination of carbon monoxide in tobacco smoke, Toth (44) in 1907 filtered the dried gas through cotton wool and after purification by successive passage over 10 per cent caustic potash, barium hydroxide, sulphuric acid, and quicklime passed the gas over iodine pentoxide heated in a glycerine bath at 60 to 70° C.

Morgan and McWhorter.—In 1907 Morgan and McWhorter (30) modified the method of Kinnicutt and Sanford by passing the iodine free gas, after absorption in potassium iodide solution, through a long test tube (24 by 2.5 cm.) containing 50 c. c. of the barium hydroxide used for the determination of carbon dioxide in air by Hesse's (21) method, and found the amount of carbon dioxide absorbed by titrating the excess of alkali with standard oxalic acid solution, using phenolphthalein as indicator.

In this connection Dennis (3) suggested as an improvement the use of a glass cylinder, about 20 cm. high and 4 cm. internal diam-

eter, fitted with a three-hole rubber stopper carrying an inlet tube, an outlet tube, and the tip of a burette. By this arrangement the solution of barium hydroxide could be titrated without transferring it to another container, thus saving it from exposure to the air. Morgan and McWhorter refer to the importance of using sealed joints in connection with the iodine pentoxide tube to prevent entrance of organic matter. When at first they used an ordinary U tube with side arms and ground-glass stoppers they experienced the difficulty of having the iodine undergo spontaneous decomposition from the entrance of vapors from lanolin used to seal the ground-glass joints, and from glycerine or oil vapor. This difficulty was removed on sealing in a blast lamp the open ends of the U tube after filling it with iodine pentoxide.

Combining the methods of Nicloux and Gautier, Morgan and McWhorter obtained a double check in the estimation of carbon monoxide, determining both the iodine and the carbon dioxide formed from the decomposition of the iodine pentoxide. By placing a tube containing standard barium hydroxide solution before the iodine pentoxide, they could determine both the free carbon dioxide and the carbon dioxide formed in the reaction. Results of two analyses are given for air containing about 0.08 per cent carbon monoxide. Iodine titration results gave values greater by 0.0007 per cent and 0.0021 per cent than the amounts taken, while carbon dioxide titration results gave values in one case greater by 0.0047 per cent and in the other less by 0.0018 per cent than the amounts taken.

Nesmyelov.—Nesmyelov (33) in 1907 verified Nicloux's statement regarding the influence of organic dust in liberating iodine from iodine pentoxide. He could not get accurate results with Nicloux's colorimetric method for determining carbon monoxide, but obtained satisfactory results using the method of Kinnicutt and Sanford. Nesmyelov, after passing his gas sample successively over sticks of caustic potash, pumice stone saturated with sulphuric acid, and iodine pentoxide heated to 150° C., determined the iodine by absorption in a known amount of N/10 sodium thiosulphate and titration with N/10 iodine. Experiments with mixtures of hydrogen and methane, using the titration method, showed no interference of hydrogen or methane at the temperature of the reaction.

Nesmyelov reported experiences with Fodor's method for quantitatively determining carbon monoxide by the use of palladious chloride and concluded that the method was not suitable for highly accurate results, but only for qualitative work. He recommended the fractional combustion method for the removal of other hydrocarbons that have a tendency to react with carbon monoxide.

Nesmyelov condemned the use of silver oxide as an oxidizing agent for the separation of carbon monoxide, hydrogen, and methane,

first, because the carbon dioxide formed in the reaction unites with some of the silver oxide, and, second, because the silver oxide is reduced by the action of hydrogen. For the same gaseous mixture, however, he recommended combustion over palladious asbestos when the passage of the gases is not too rapid, e. g., when the rate of aspiration is about 1 liter per hour. He reported good results for combustion over copper oxide at 250° C., and stated that at that temperature methane was not involved in the reaction and that the rapidity of the passage of the gas mixture was of no importance.

Weiskopf.—Weiskopf in 1909 (45) reported that while ordinary sulphuric acid did not hold back olefines, this could be effected by the use of 99 per cent to 99.5 per cent sulphuric acid heated to 165° C. He passed his gas mixture successively through a purifying train consisting of (1) a U tube with glass wool and pumice stone saturated with sulphuric acid, (2) Liebig bulbs filled with 99 per cent sulphuric acid at 165° C., (3) a sulphuric acid spiral, (4) a caustic potash bulb, (5) a sulphuric acid spiral, and (6) a U tube with pumice stone saturated with sulphuric acid.

The iodine pentoxide was contained in a spiral tube with tight ground-glass joints, thus obviating the use of a lubricant, and was heated in an oil bath to 150°. The delivery tube from the iodine pentoxide tube dipped directly into an absorption tube containing 5 cc. of a 15 per cent solution of potassium iodide. The gases were finally dried in a U tube and the carbon dioxide formed in the reaction caught in an absorption flask. In a gas mixture containing 0.999 per cent volume of carbon monoxide and 4 per cent volume of carbon dioxide, together with approximately known quantities of methane, ethylene, hydrogen, nitric monoxide, oxygen, and nitrogen, he found 0.97 per cent volume of carbon monoxide and 4.11 per cent volume of carbon dioxide.

Goutal.—In 1910 Goutal (16) described a portable form of apparatus which he used. The iodine pentoxide mixed with glass wool was contained in a straight tube and maintained there at 200° in a current of pure dry oxygen for several hours. As a purifying train he used a tube of cotton wadding and wash flasks or U tubes containing successively a slight acid solution of copper sulphate, 15 per cent caustic potash, and pumice stone saturated with sulphuric acid. To remove unsaturated hydrocarbons, the air was passed successively through concentrated sulphuric acid, bromine, and caustic potash; in general, however, Goutal found this procedure unnecessary.

The iodine pentoxide was heated in a water bath kept at 75° by the flame of an alcohol lamp. To prevent condensation of small quantities of the iodine at the end of the tube, this was heated for periods of about a minute from time to time by the alcohol lamp.

Air was aspirated through the apparatus at the rate of about 1 liter per hour and the carbon monoxide determined colorimetrically by the depth of color that the liberated iodine imparted to a chloroform solution, or in case sufficient iodine was present, it could be determined by titration with sodium thiosulphate. A detailed method is given for the establishment of the iodine chloroform color standards. If the chloroform is only very faintly colored (which is the case with a carbon monoxide content below 0.005 per cent) the aspirator is again filled with water and the operation renewed until the development of a tint sufficient to render possible a colorimetric determination. With this method Goutal was able to detect 10 parts of carbon monoxide in a million parts of air without the need of aspirating more than two liters of air.

Gill and Bartlett.—Gill and Bartlett, in 1910 (17), repeated the work of Smits, Raken, and Terwogt, but could not confirm their findings. In attempting to apply the iodine pentoxide method to the determination of carbon monoxide in illuminating gas, using known amounts of carbon monoxide varying from 21.8 c. c. to 25.9 c. c., in five analyses they obtained but one result which checked, while in the four others there were losses of from 1 per cent to 4.3 per cent of the total amount used. The time of passing the mixture through the iodine pentoxide, which was heated at temperatures between 150 and 161° C., was from 29 minutes to 2½ hours.

In mixtures of carbon monoxide, hydrogen, and methane, corresponding approximately to the composition of the residual gas after carbon dioxide, "illuminants," and oxygen had been removed from the illuminating gas, an excess of from 3.1 per cent to 18.6 per cent more carbon monoxide was found over that originally present in the mixture. Gill and Bartlett could not account for these irregular results, other than by the possibility of the iodine pentoxide undergoing spontaneous decomposition.

Levy.—In 1911 Levy (25), in seeking a rapid method for estimating carbon monoxide, aspirated the gas through a gold chloride solution and measured the amount of the gas from the intensity in color of the reduced gold chloride. He abandoned the method as unsatisfactory and experimented with a portable form of apparatus using iodine pentoxide.

The gas for analysis was passed successively through bromine in potassium bromide to remove unsaturated hydrocarbons, caustic potash to remove carbon dioxide, a drying tube of phosphorus pentoxide, then through two U tubes, one containing iodine pentoxide mixed with small pieces of asbestos which had been previously ignited and the other with copper turnings to retain the liberated iodine. These two U tubes were heated in an air oven to 160–180° C. Aspiration of air through a fixed volume of standard barium hydroxide solution

colored by phenolphthalein was continued until just enough carbon dioxide, liberated in the reaction, had passed through the apparatus to neutralize and decolorize the barium hydroxide solution.

From the volume of air passed through the apparatus to effect decolorization and from the strength of the barium hydroxide solution, the percentage of carbon monoxide was calculated. Results given for mixed coal gas and water gas containing from 12 to 17 per cent of carbon monoxide, and for these gases diluted to from 0.8 per cent to 1.7 per cent of carbon monoxide, showed low values for the latter. An error of 0.3 per cent was reported.

Chance.—In the same year Chance (2) in examining mine air used the method of Kinnicutt and Sanford with a few slight modifications. A copper can containing the air sample was placed in a vertical position, and so arranged that water entered through the bottom tap. As it rose, the contained air passed through the upper tap into an absorption train. This consisted of a U tube, the first leg of which contained calcium chloride, the second soda lime. As practically no unsaturated hydrocarbons were present in mine air, a sulphuric acid tube was dispensed with.

The sample next passed through the iodine pentoxide tube, which was heated in a sand bath kept between 150° to 160° C. in a Bowen absorption tube containing 5 c. c. of a 10 per cent solution of potassium iodide. The gas was passed through the apparatus at the rate of about 1 liter per hour, 1 liter of air being the quantity usually analyzed.

Marcelet.—Marcelet (28) in 1911 made determinations of the amount of carbon monoxide in tobacco smoke. In using the Lévy and Pecoul procedure he found that a large part of the iodine liberated from the iodine pentoxide was deposited in parts of the tube emerging from the air bath. Marcelet obtained only very small quantities of carbon monoxide by this method in atmospheres previously analyzed by gasometric methods. He observed the same deviation in the analyses of laboratory illuminating gas by the two methods. He attributed the low results to an incomplete reaction due to insufficient thickness of the layer of iodic acid traversed. However, on greatly diluting the gas from tobacco smoke he was able to get concordant results using iodine pentoxide.

Herman.—In 1913 Herman (20), in making analyses of carbon monoxide in the air, used arsenious acid as an absorption liquid for the iodine liberated from iodic acid. Nowicki in 1906 had titrated the free iodine with arsenious acid. Herman absorbed the iodine given off from the reaction in a known excess of standard arsenious acid and titrated back the excess of the acid with a N/100 iodine solution. After passing the gas mixture through U tubes of caustic-potash solution, pumice stone saturated with sulphuric acid, and iodic acid

warmed to about 110° C. in a bath of ammonium sulphate, he caught the liberated iodine in one or more Winkler tubes containing arsenious acid. The gas was aspirated through the apparatus at a rate not exceeding 1 liter per hour. In order to carry over the last traces of liberated iodine, Herman found it necessary to pass a current of pure air through the apparatus for five hours. In working on mixtures of air and pure carbon monoxide, using 5 liters of the sample, he was able to determine only 1 part of carbon monoxide in 10,000 of the air mixture.

Burrell and Seibert.—In a publication of the United States Bureau of Mines, in 1913, Burrell and Seibert (1) described some new modifications in the apparatus for determining carbon monoxide. These included an electrically heated, wire-wound jacket for holding the iodine pentoxide tube and the use of a bulb burette for measuring the sample. The bulb burette consisted of eight bulbs, each having a capacity of 100 c. c., joined together by a narrow graduated constriction between each bulb, permitting measurements to be accurately made at atmospheric pressure by means of a leveling bottle. A constant temperature of 150° C. was maintained by the use of a thermocouple, which was placed inside the straight iodine pentoxide tube. The carbon dioxide produced in the reaction was absorbed by a standard solution of barium hydroxide and the excess was titrated with an oxalic acid solution containing 0.56325 grams per liter.

The purifying train consisted in general of the following arrangement: (1) Pumice stone and sulphuric acid, (2) lead acetate for retaining hydrogen sulphide if present, (3) a standard solution of barium hydroxide for retaining any carbon dioxide in the sample, (4) pumice stone and sulphuric acid, (5) fuming sulphuric acid, (6) concentrated sulphuric acid, (7) potassium hydroxide solution, (8) concentrated sulphuric acid. A guard tube containing soda lime was placed between the flask containing the standard barium hydroxide solution and the aspirator bottle.

Before making determinations, Burrell and Seibert passed air for several hours over the iodine pentoxide heated to 200°. At the conclusion of an experiment air was passed through a purifying train of caustic potash solution and a tube of soda lime.

These investigators found that in "after-damp" following mine explosions, in air vitiated by the firing of explosives in mines, or in air vitiated by the exhaust from gasoline locomotives, etc., wherever the carbon monoxide is present in amounts less than 0.2 per cent, gases other than carbon monoxide that reduce iodine pentoxide are seldom present in sufficient quantity to necessitate the use of the long purifying train above described.

In a mixture of carbon monoxide and air containing 0.04 per cent of carbon monoxide as determined by a combustion analysis made

with a modified Haldane apparatus, the analysis by the iodine pentoxide method using 800 c. c. of sample gave 0.043 per cent of carbon monoxide. The authors state that they obtained good results with mixtures of illuminating gas and air. In the case of an analysis where they used a mixture of carbon monoxide, methane, and hydrogen, the gaseous mixture being passed over a purifying train consisting of two wash bottles of concentrated sulphuric acid and two of caustic potash solution, the time required for the determination was about two and a half hours. The greatest difference in such a mixture between the results of combustion analyses and the iodine pentoxide method was 0.018 per cent.

Seidell.—In 1914, as a preliminary to a study of the gaseous impurities in the air of railway tunnels, Seidell (37, 39) took up the determination of carbon monoxide. His principal contribution to the technique of this determination consisted in the use of an improved form of absorption bulb for absorbing constituents from gaseous mixtures. As stated by Seidell (38) these bulbs have the following advantages: (1) A small air space, thus diminishing the amount of air that has to be swept through the apparatus for purification purposes; (2) the contents of the bulbs are easily transferable at the completion of an analysis; (3) the bulbs can be easily cleaned; (4) the series of three small bulbs composing one set of this absorption apparatus readily permits observation of the efficiency of the absorption; thus, where potassium iodide and starch are used in the absorption bulbs, the absence of a blue color in the last bulb shows that no iodine has passed beyond the first and second bulbs; (5) these bulbs can be readily made in the laboratory, but little experience in glass blowing being required.

The gas under examination, displaced from the sample bottle by water entering at the rate of about 2 to 3 liters per hour, was passed through a purifying train of sulphuric acid and potassium hydroxide, and then over iodine pentoxide heated in an oil bath at 150° C. The liberated iodine was absorbed in a 1 per cent potassium iodide solution containing 0.5 c. c. of 0.5 per cent arrowroot starch solution and titrated with N/1000 sodium thiosulphate. The carbon dioxide liberated was absorbed in standard barium hydroxide solution. The titration of the latter could therefore serve as a check on the results with the former.

Blank determinations with mixtures of 2,500 c. c. of carbon monoxide and air containing from 36 to 360 parts of carbon monoxide per million parts of air gave an analysis from 88 to 98 per cent of the original amounts. While relatively this appears to be a large loss, if the very minute quantities of gas are taken into consideration, these differences are really small. More accurate results are reported

for carbon monoxide determined by titration of the iodine liberated than by titration of the liberated carbon dioxide.

Sinnatt and Cramer.—Sinnatt and Cramer (40) in 1914 criticized previous methods of determining carbon monoxide, based on absorbing the liberated carbon dioxide by barium hydroxide, because of the time required to obtain perfect absorption of the carbon dioxide by the barium hydroxide solution, the uncertainty arising from the action of dilute solutions of barium hydroxide on the glass during a long period, the prevention of contact with the air and breath of the experimenter, and the difficulty of titrating the reacting liquid at the completion of an estimation.

Their method depends on the collection of the whole of the carbon dioxide after the carbon monoxide has been oxidized with iodine pentoxide. The gas was collected in a dry flask, which admitted of the carbon dioxide present being determined by Pettenkofer's process. A known volume of the gas was drawn through wash bottles containing fuming sulphuric acid, aqueous potassium hydroxide, concentrated sulphuric acid, then through two long tubes containing solid potassium hydroxide, so as to remove any unsaturated hydrocarbons, carbon dioxide, and moisture. The gas then passed through a tube filled with alternate layers of iodine pentoxide and glass wool, and was heated in a paraffin bath to 140–160° C. The rate of aspiration was about 1 liter per hour.

The iodine liberated was absorbed in a tube containing mercury, while the carbon dioxide formed was collected in an evacuated flask into which standard barium hydroxide was admitted. The excess of alkali was then titrated with N/20 hydrochloric acid, without transferring the solution. Amounts of carbon monoxide varying from 0.025 per cent to 2.15 per cent were thus determined. When checked against determinations by oxidation with copper oxide, the method showed variations ranging from about 0.001 per cent in case of the smaller amounts to about 0.25 per cent with the larger amounts of carbon monoxide.

Graham and Winmill.—In the same year Graham and Winmill (18) devised an apparatus which is essentially a modification of the Haldane type of gas analysis apparatus. It is designed to measure the contraction which occurs when a mixture containing carbon monoxide is passed over heated iodine pentoxide and the products of the reaction are treated with caustic potash. This contraction in volume is a measure of the quantity of the carbon monoxide present in the original sample.

Three absorption pipettes containing respectively 25 per cent potassium hydroxide solution, bromine in an aqueous solution of potassium bromide, and 45 per cent solution of potassium hydroxide, followed by an iodine pentoxide tube, and, finally, by another ab-

sorption tube containing 45 per cent potassium hydroxide. Graham and Winmill stated that the reaction with iodine pentoxide was rapid and complete at a temperature of 90 to 100° C.

They showed that hydrogen in the absence of carbon monoxide was attacked by iodine pentoxide at temperatures above 135° C., and that when carbon monoxide was present, oxidation of the hydrogen took place at lower temperatures as the percentages of these gases increased. They found that if the mixture contained less than 20 per cent of hydrogen and less than 8 per cent of carbon monoxide, an accuracy of 0.02 per cent could be obtained, while if the concentration of hydrogen was below 1 per cent, amounts of carbon monoxide up to 25 per cent could be satisfactorily estimated. They concluded that for accurate analysis of mixtures rich in hydrogen and carbon monoxide the sample should be diluted with air to bring the concentration of the hydrogen below 20 per cent and that of the carbon monoxide below 8 per cent. Examination of mixtures of carbon monoxide and air containing from 0.02 per cent to over 24 per cent of carbon monoxide gave variations of from 0.01 per cent to 0.03 per cent from the original amounts used.

Froboese.—Froboese in 1915 (6) experimented with mixtures of carbon monoxide and air containing about 0.6 per cent carbon monoxide and about 21 per cent carbon monoxide, and with mixtures of carbon monoxide and hydrogen containing 0.6 per cent and 20.5 per cent carbon monoxide, using temperatures of 70 and 160° C. for heating the iodine pentoxide. The carbon monoxide was determined by titration of the iodine, and also by titrating the excess of barium hydroxide, or by dissolving the barium carbonate in hydrochloric acid, precipitating with sulphuric acid and weighing the barium sulphate. The iodine pentoxide tube was heated to 160° and air passed through for an hour before use. The air sample was passed through a purifying train consisting of a solution of potassium hydroxide, sticks of potassium hydroxide, and concentrated sulphuric acid. With small amounts of carbon monoxide, dry air free from carbon dioxide was passed through for half an hour after a determination in order thoroughly to sweep the apparatus.

Froboese found that hydrogen was oxidized by the iodine being liberated. At 70° C. the reaction with hydrogen was but slight, but at 160° C. large quantities of free iodine were formed. After prolonged use it was found that the iodine pentoxide was colored slightly yellow, due to detained iodine.

More trustworthy results were obtained from the carbon dioxide than from the iodine formed in the reaction. In the case of air mixtures containing about 0.6 per cent carbon monoxide, results were obtained that differed by 0.01 per cent, and in the case of air mixtures containing about 21 per cent carbon monoxide differences of about

0.2 per cent were obtained from the percentages used. Methane alone had no action upon iodine pentoxide at 160°.

Froboese concluded that the iodine reaction gave very nearly correct results with atmospheric air containing a small amount of carbon monoxide (up to 0.5 per cent), provided that air free from carbon monoxide and carbon dioxide was passed over the iodine pentoxide heated at 100° C. for an hour before and after passage of the air under examination, and that the carbon monoxide content of the gas was without influence if the rate of aspiration did not exceed one liter per hour.

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APPENDIX B.

CASE OF WHOLESALE CHRONIC CARBON MONOXIDE POISONING.

The following case of wholesale chronic carbon-monoxide poisoning reported by Morel and Mouriquand[1] is extremely interesting from many points of view. These investigators give the particulars of an instance in which of about 40 persons in one building 34 suffered from chronic carbon monoxide poisoning.

The building in question was large and contained a number of rooms about 6½ meters high. These rooms were occupied for about eight hours a day, and were unoccupied on Sundays and for several months during the summer. Chemical analysis of the air, which was repeated several times, showed that in the majority of the rooms there were abnormal amounts of carbon monoxide which were greater in winter than in summer. The presence of carbon monoxide-hemoglobin was also demonstrated by spectroscopic examination of ox blood, which was exposed to the air of one of the rooms used regularly in winter by several of the people under observation, and by examination of a little human blood furnished by a patient at the time he suffered an attack of headache and vertigo after prolonged stay in this atmosphere. Chemical examination of the air of the room in which this patient had been determined by the Leroy and Pecoul iodine pentoxide method showed the presence of carbon monoxide amounting [illegible] parts of carbon monoxide per million parts of air. Using this method in different rooms the smallest and largest amounts of carbon monoxide were present, ranging from 1 in [illegible] to 1 in [illegible] parts of carbon monoxide per million parts of air.

An examination [illegible] bon monoxide in the [illegible] the persons most [illegible] precisely those [illegible] highest amount [illegible] amination of [illegible] pied by the [illegible]

[1] [illegible] Ann. d'hygiène, 3e série, t. xxxvi, p. 161, No. 4, p. 49.

the symptoms of carbon monoxide poisoning showed the complete, or nearly complete, absence of carbon monoxide. These chemical tests were made during intervals of a period of three years (1908–1910).

An examination of the causes of the presence of carbon monoxide showed that the conditions of this building had been as bad from the point of view of the distribution of illuminating gas during the years previous to the chemical findings just mentioned. The important source of constant leakage of illuminating gas was the diffusion through the joints of the pipes and around the rings of badly fitting gas cocks. Gas-meter measurements showed that the piping throughout the rooms of the building (the rooms had a total cubic content of 7,000 to 8,000 cubic meters) permitted as much as 36 cubic meters of gas to escape into the air of the rooms during a 24-hour period, although every gas cock was closed except that leading to the gas meter. As the illuminating gas supplied to this building contained between 12 to 14 per cent of carbon monoxide, it can be imagined what accumulation of this poison might occur in rooms which were not perfectly ventilated. From the investigation of the conditions of this building it was found that these escapes of gas had been at least as great in the eight preceding years. In addition, defective hot-air heaters which were known to be in use for 10 winters added their quota of carbon monoxide. All of the patients who had lived in this building showed approximately identical symptoms, varying in intensity. Their disturbances generally appeared with all their clinical clearness after the patient had stayed from two to three years in the suspected building, appearing in the early winter and then growing progressively until the spring, and in certain cases until the summer. The beginning was marked by headaches, accompanied sometimes by dizziness. The patients felt sleepy during the day and were overcome by a kind of torpor and inaptitude for work which were inexplicable. They exhibited general weakness, nervous troubles, such as neuralgias and impairment of the memory and digestive disturbances, such as hyperchlorhydria. Twelve of the patients showed intermittent albuminuria; three had temporary albuminuria. Several patients were so affected in their general health that they were considered candidates for tuberculosis institutions. The majority of the patients grew thin and extremely pale. More than half of the patients who had albuminuria had either hereditary or personal albuminuric antecedents. Three patients under 35 years of age who showed alimentary glycosuria at the height of their nervous and hyperchlorhydric troubles were all the sons of diabetic parents. The injurious agent, carbon monoxide, had thus brought out in these cases the hereditary or anterior trait. All these symptoms correspond to the clinical manifestations of chronic carbon mon-

oxide poisoning. The disorders of all the patients appeared while frequenting this building. Symptoms of illness were shown several weeks after returning from their vacations and several days after the heating began. The nervous and digestive troubles followed the same course, appearing in the winter, attaining their maximum in March and April, then gradually diminishing, and finally disappearing during vacations. In the 12 patients showing albuminuria, it always reappeared after a somewhat prolonged stay in the building. It always disappeared when they left it or in the cases in which the patients on suspecting their exposure to gas poisoning worked with open windows. The same thing was true of glycosuria.

Regarding the influence of a stay of some years in this contaminated atmosphere it was shown that while a slightly prolonged stay outside the building during the first years of exposure to the gas poisoning sufficed to remove the troubles, these disorders were shown later on to be more and more resistant to open-air treatment, so that at the end of a stay of from six to eight years, three months in the open air brought about an improvement, but not a complete cure. In certain cases a complete cure was effected only after the patient left the building for from one to two years. The report of Morel and Mouriquand must be regarded as important, as it was shown definitely (1) that abnormal amounts of carbon monoxide existed in the different apartments of the building; (2) that the symptoms of slow poisoning presented by the patients who lived in these apartments were those of chronic carbon monoxide poisoning; (3) that there was a definite relation existing between the appearance and the disappearance of these symptoms and the stay in the building; (4) that chronic poisoning may take place when people inhabit for years places where they breathe concentrations of carbon monoxide ranging from 1 in 10,000 to 1 in 1,000, or from 100 to 1,000 parts of carbon monoxide per million parts of air; (5) that many people do not establish tolerance to amounts of carbon monoxide varying from 1 in 10,000 to 1 in 1,000, or from 100 to 1,000 parts of carbon monoxide per million parts of air, and that they suffer from the ill effects of breathing this poison so long as they inhabit dwellings containing such noxious accumulations of gas; (6) that when persons remained in such contaminated atmospheres for from six to eight years it required months of open-air treatment even to bring about improvement, to say nothing of a cure, this in certain cases being effected only after the patient left the building for from one to two years.

RELATED PUBLICATIONS.

[Literature bearing upon the subject of vocational diseases issued by the Public Health Service, from which copies may be obtained without charge.]

PUBLIC HEALTH BULLETINS:

No. 71. Studies in Vocational Diseases. I. The Health of Garment Workers. By J. W. Schereschewsky. II. The Hygienic Conditions of Illumination in Workshops of the Women's Garment Industry. By J. W. Schereschewsky and D. H. Tuck. August, 1915.

No. 73. Tuberculosis Among Industrial Workers: Report of an Investigation Made in Cincinnati, with Special Reference to Predisposing Causes. By D. E. Robinson and J. G. Wilson. April, 1916.

No. 76. Health Insurance: Its Relation to the Public Health. By B. S. Warren and Edgar Sydenstricker. March, 1916.

No. 78. Influence of Occupation on Health during Adolescence. Report of a physical examination of 679 male minors under 18 in the cotton industries of Massachusetts. By M. Victor Safford.

No. 81. Studies in Vocational Diseases. The Effect of Gas-Heated Appliances Upon the Air of Workshops. By Charles Weisman. January, 1917.

PUBLIC HEALTH REPORTS:

Trachoma in Steel Mill Workers. An Investigation of the Origin and Prevalence of the Disease Among the Employees of the Youngstown Sheet & Tube Co., Youngstown, Ohio. By J. W. Schereschewsky. March 6, 1914.

REPRINTS FROM THE PUBLIC HEALTH REPORTS:

No. 195. Industrial Conditions. Their Relations to the Public Health. By B. S. Warren. May 29, 1914.

No. 197. Industrial Insurance. Medical Examination of Employees and Prevention of Sickness its Proper Function. By J. W. Schereschewsky. June 5, 1914.

No. 234. Physical Examination of Workers. By J. W. Schereschewsky. November 20, 1914.

No. 250. Sickness Insurance: Its Relation to Public Health and the Common Welfare. By B. S. Warren. January 8, 1915.

No. 302. Industrial Hygiene. A Plan for Education in the Avoidance of Occupational Diseases and Injuries. By J. W. Schereschewsky. October 1, 1915.

No. 335. Statistics of Disability. A Compilation of Some of the Data Available in the United States. By B. S. Warren and Edgar Sydenstricker. April 21, 1916.

SUPPLEMENT TO THE PUBLIC HEALTH REPORTS:

No. 17. Sanitary Survey of Indiana Industries Employing Woman Labor. By M. J. White. July 17, 1914.

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TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN NO. 82
NOVEMBER, 1916.

TRANSACTIONS OF THE FOURTEENTH ANNUAL CONFERENCE OF STATE AND TERRITORIAL HEALTH OFFICERS WITH THE UNITED STATES PUBLIC HEALTH SERVICE

HELD AT WASHINGTON, D. C.
MAY 13 AND 15, 1916

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

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LETTER CALLING THE CONFERENCE.

TREASURY DEPARTMENT,
BUREAU OF THE PUBLIC HEALTH SERVICE,
Washington, March 9, 1916.

DEAR DOCTOR: I take pleasure in informing you that the fourteenth annual conference of State and Territorial health authorities with the United States Public Health Service will be held at this bureau May 13 and 15, 1916, beginning at 10 a. m., May 13.

It is respectfully urged that your State be represented, as important public-health matters will be brought before the conference for action. Copy of the provisional program will be mailed to you in the near future.

I shall be obliged to you for letting me know as soon as practicable the name of the delegate selected to represent your State.

Respectfully,

RUPERT BLUE,
Surgeon General.

STANDING COMMITTEES.

Morbidity returns:
- Dr. A. J. Chesley, chairman.
- Dr. F. M. Meader.
- Dr. E. R. Kelley.
- Dr. C. Hampson Jones.
- Dr. J. W. Trask, secretary.

Sanitation of public conveyances:
- Dr. Oscar Dowling, chairman.
- Dr. J. N. Hurty.
- Dr. T. B. Beatty.
- Dr. W. F. Cogswell.
- Dr. C. H. Creel, secretary.

Interstate quarantine regulations:
- Dr. J. S. Fulton, chairman.
- Dr. E. G. Williams.
- Dr. H. M. Bracken.
- Dr. S. J. Crumbine.
- Dr. T. B. Beatty.
- Dr. W. C. Rucker, secretary.

Intrastate quarantine regulations:
- Dr. W. C. Woodward, chairman.
- Dr. C. W. Garrison.
- Dr. W. A. Sawyer.
- Dr. E. R. Kelley.
- Dr. W. C. Rucker, secretary.

Health insurance:
- Dr. W. C. Woodward, chairman.
- Dr. B. S. Warren, secretary.

Rural sanitation:
- Dr. W. S. Rankin, chairman.
- Dr. T. D. Tuttle.
- Dr. C. F. Dalton.
- Dr. J. A. Hayne.
- Dr. L. L. Lumsden, secretary.

Standard methods of public-health accounting:
- Dr. A. J. McLaughlin, chairman.
- Dr. C. St. Clair Drake.
- Dr. S. L. Jepson.
- Dr. G. F. Swarts.
- Dr. Carroll Fox, secretary.

Increasing efficiency of conferences:
- Dr. L. R. Williams, chairman.
- Dr. W. C. Woodward.
- Dr. T. D. Tuttle.
- Dr. J. W. Kerr, secretary.

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- Codification of sanitary regulations for intrastate use, Dr. W. C. Woodward, chairman.
- Morbidity reports, Dr. E. G. Williams, chairman.
- Investigations of pellagra, Dr. J. A. Hayne, chairman.
- Sickness insurance, Dr. W. C. Woodward, chairman.

New business:
- The use of morbidity reports in State health work.
- The model State law for morbidity reports: Consideration of amendments thereto.
- The collaborating epidemiologists: Their functions and achievements.
- Establishment of an "Area of known disease prevalence." Is it practicable and desirable at the present time? What diseases should be reported and what standard required for admission?
- "Sanitation week" observance: Views of the conference as to desirability of designating such special week. Methods for its observance.
- Industrial sanitation: Present status of this phase of sanitation in the various States and relation of the State health authorities to it.
- School hygiene: Scope of this subject, the extent of legislation so far in force, and the functions of health authorities.
- Rural sanitation: Relation of rural sanitation to general sanitation. Extent to which it should be supervised and carried on by constituted health authorities.
- Malaria: Development of a uniform plan of campaign sufficiently extensive to embrace widely separated infected areas.
- Constitutional diseases: The extent to which they are public-health problems. Official measures that may be inaugurated to reduce the increasing death and sickness rates from these diseases.
- Nutritional disorders: Their relation to the public health. What concerted action by health authorities is indicated to eradicate them?
- Standard methods of collecting public-health information: Is the adoption of uniform methods of accounting desirable and practicable? If so, what schedules should be used.
- Laboratory activities: The last session of the conference (May 15, at 2 p. m.) will be devoted to a survey of the operations of the Hygienic Laboratory of the United States Public Health Service. Demonstrations will be given on this occasion of certain activities of the laboratory, as, for example, the standardization of antitoxins, the preparation of vaccines, methods of waste disposal, etc.

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Fourteenth Annual Conference of the State and Territorial Health Authorities with the Public Health Service.

TRANSACTIONS.

Morning Session, May 13, 1916.

The fourteenth annual conference of the State and Territorial health authorities with the Public Health Service was called to order at 10 o'clock a. m., May 13, 1916, at the building of the Public Health Service, New Jersey Avenue and B Street SE., Washington, D. C.

Surg. Gen. Rupert Blue presided as chairman, and Asst. Surg. Gen. J. W. Kerr acted as secretary.

The following official and other representatives were present:

Arkansas, Dr. C. W. Garrison.
California, Dr. W. A. Sawyer.
Connecticut, Dr. J. T. Black, Dr. J. Frederick Jackson, and Dr. Louis J. Pons.
Delaware, Dr. A. E. Frantz and Dr. William T. Orr.
District of Columbia, Dr. W. C. Woodward.
Georgia, Dr. H. F. Harris.
Hawaii, Dr. D. S. Bowman.
Idaho, J. K. White.
Illinois, Mr. Paul Hansen.
Indiana, Dr. J. N. Hurty, Dr. J. S. Bowyers, and Dr. Charles B. Kern.
Kansas, Dr. Charles H. Lerrigo.
Louisiana, Dr. W. H. Seemann.
Maryland, Dr. John S. Fulton.
Massachusetts, Dr. A. J. McLaughlin and Dr. Eugene R. Kelley.
Michigan, Dr. John L. Burkhart and Dr. A. P. Biddle.
Minnesota, Dr. H. M. Bracken, Dr. A. J. Chesley, and H. A. Whittaker.
Mississippi, Dr. W. S. Leathers.
Montana, Dr. W. F. Cogswell.
New Jersey, Dr. William H. Chew, Dr. R. B. Fitz Randolph, and Dr. Millard Knowlton.
New York, Dr. L. R. Williams and Dr. John A. Smith.

North Carolina, Dr. W. S. Rankin.
Ohio, Mr. J. G. Bowman.
Rhode Island, Dr. G. T. Swarts and Dr. Thomas J. McLaughlin.
South Carolina, Dr. J. A. Hayne.
Vermont, Dr. C. F. Dalton.
Virginia, Dr. E. G. Williams.
Washington, Dr. T. D. Tuttle.
West Virginia, Dr. S. L. Jepson.
Wisconsin, Dr. C. A. Harper and Dr. William F. Whyte.

Representatives of the United States Public Health Service:

Surg. Gen. Rupert Blue.
Asst. Surg. Gens. W. G. Stimpson, J. W. Kerr, W. C. Rucker, and J. W. Trask.
Surgs. H. S. Cumming, T. Clark, L. L. Lumsden, C. Fox, J. Goldberger, G. W. McCoy, B. S. Warren, F. C. Smith, E. A. Sweet.
Passed Asst. Surg. W. F. Draper.
Prof. C. W. Stiles.

Guests:

Dr. T. R. Crowder, director of department of sanitation of the Pullman Co.
S. Juanita McFarland, West Virginia.
Miss Gertrude Seymour, "The Survey," New York City.

Opening Remarks by the Surgeon General.

The Surgeon General. It is my pleasant duty to call to order the fourteenth annual conference of State and Territorial health authorities with the Public Health Service, and to extend on behalf of the Treasury Department and this bureau a cordial welcome to the official State delegates and those whom we have invited to participate in our discussions.

It has been the custom in the past for your chairman to give a brief review of the activities of the service during the preceding year, but on account of the character and scope of our program it does not seem necessary to do so at this meeting. In passing, however, I should like to mention the fact that the revised interstate quarantine regulations, to which much of the time of the last annual conference was given, have been approved and promulgated. I believe that as they stand they represent the most effective measures which the Federal Government has taken to cooperate with State and local boards of health in preventing the interstate spread of disease. I believe the Public Health Service is indebted to those who, at the last annual conference, gave to these regulations such thorough and painstaking consideration.

On account of the undue prevalence of rabies in the Rocky Mountain States and the presence of infection among wild animals, a special conference was called on request of certain western States. This conference was held at Salt Lake City on February 2–3, 1916.[1] Subsequently two medical officers from the service have been sent there to render such assistance as might be practicable.

The program before you is provisional, and I trust that you will feel at liberty to discuss the subjects that have been outlined and to introduce any others that you may consider of sufficient interest and importance to this body.

The secretary will please call the roll by States and Territories.[2]

With your approval, in order to expedite the business of the conference, the chair will appoint a committee on resolutions, consisting of five members. These names will be announced later.[3]

Reports of Committees.

Codification of sanitary regulations for intrastate use.

We will first take up the codification of sanitary regulations for intrastate use, Dr. W. C. Woodward, chairman.

Dr. Woodward. Mr. Chairman, your recorder and myself have prepared a report which I hope the other members of the committee will approve after hearing it read:

The committee which was appointed by the Surgeon General, under date of February 28, 1916, for the purpose of considering the adoption of the interstate quarantine regulations for intrastate purposes, begs to report that after considering the question carefully it is of the opinion:

1. That the adoption of uniform intrastate quarantine regulations as a reinforcement of the interstate quarantine regulations is a necessity; and

2. That on account of the great diversity in the intrastate regulations of the various States a very careful study of the existing regulations will be necessary in order to formulate a model code of intrastate regulations.

In view of these facts your committee recommends that the Surgeon General appoint a committee of three for the purpose of making a careful study of the existing intrastate regulations and to present to the next annual conference of the State and Territorial health authorities with the Surgeon General a model code of intrastate quarantine regulations.

W. C. Woodward, M. D.,
Chairman.
T. D. Tuttle, M. D.,
Charles F. Dalton, M. D.,
Wm. C. Rucker, M. D.

(The report was agreed to by the other members of the committee present and approved by the conference.)

[1] Transactions of this conference published as Public Health Bulletin No. 80.

[2] The result of this roll call will be found on pp. 11 and 12.

[3] Those appointed were: Drs. W. A. Sawyer, W. C. Rucker, W. S. Rankin (replacing Dr. L. R. Williams, appointed on the committee, but unable to remain for the session of May 15), C. W. Garrison, and T. D. Tuttle.

The SURGEON GENERAL. We will next take up the report of the committee on sickness insurance, of which Dr. W. C. Woodward is also chairman.

Dr. WOODWARD. Mr. Chairman, your committee on sickness insurance, or health insurance—which I think is a better term—begs to submit the following report:

Health insurance, as usually operated under governmental systems, provides that all employed persons in certain occupations, and all persons in other occupations earning less than a specified annual income, be entitled in case of illness to certain benefits.

Benefits.—The benefits ordinarily provided are:

(*a*) Cash payment for a limited period (usually 26 weeks in any 12 months) of a proportion of the wage, or of a fixed sum, to employees, when disabled by sickness or nonindustrial accident (industrial accidents are provided for under workmen's compensation laws).

(*b*) Medical benefits, which include adequate medical and surgical care, medicines, and appliances in home, hospital, sanatorium, or physician's office, to employees disabled on account of sickness or nonindustrial accident during a limited period (26 weeks in any 12 months).

(*c*) Maternity benefits, which include cash payment of a small sum in case of confinements of employees or wives of employees.

(*d*) Cash payment for deaths of insured persons due to sickness or nonindustrial accidents of an amount calculated to cover funeral expenses.

Funds.—The funds are usually provided by payments from employees, employers, and Government appropriations. In Germany the employee pays two-thirds, employer one-third, and the Government pays for certain expenses of supervision. Under the English national insurance act the employee pays four-ninths, the employer three-ninths, and Parliament appropriates two-ninths. In the case of women and persons employed at certain low levels of wages the payments of employer and Parliament are increased and the proportion paid by employee is decreased.

Administration.—The administration, both central and local, is usually according to some form of representative government. In the local government, in addition to governmental bodies created for the purpose, unions, industrial establishments, and certain societies are utilized for purposes of the local administration of the funds.

Extent of health insurance.—In foreign countries voluntary health-insurance systems have been subsidized by the Governments of France, Belgium, Denmark, Sweden, and Switzerland. But more significant as an evidence of the recognition of the efficacy of health insurance is the fact that compulsory systems have been established in Germany, Austria-Hungary, Norway, Great Britain, Servia, Russia, Luxemburg, Roumania, France (for miners, seamen, and railway employees), and Italy (for railway employees).

In this country we are in the first stage in health insurance. No State, municipal, or other government in any way provides for or aids health insurance. There are, however, large numbers of private systems, such as mutual benefit associations and other societies, which provide for health insurance. In addition to these there are various employers' benefit associations, trade-union benefits, and commercial insurance with health-insurance policies.

Bills providing for the establishment of governmental health-insurance systems have been introduced in the Legislatures of Massachusetts, New York,

and New Jersey. In California a State commission has been created for the study of social insurance.

Occupational-disease insurance.—In several States occupational diseases have been included in the workman's compensation acts and the constitutionality of these laws has been upheld by the State supreme courts. This shows a tendency on the part of law makers to apply insurance methods in provisions for sickness. Few diseases, however, are altogether due to the hazard of the occupation; in fact, at times the occupational hazard may be greatly aggravated by other conditions which cause impaired resistance in the worker. Thus the responsibility for many of the so-called occupational diseases is divided, and the classing of them with industrial accidents is not only often impracticable but it tends to load on the employer a responsibiilty which is not altogether his.

The need for health insurance.—The economic cost to every community and to the Nation of preventable diseases and deaths is greatly increased by the unusual prevalence of these diseases and deaths among the unskilled and low-paid industrial workers. All available statistics, both in the United States and in foreign countries, indicate that among those of a low economic status the morbidity and mortality rates are higher than in the rest of the population.

The result of an investigation made for the Federal Commission on Industrial Relations afforded the estimate that each of the 30,000,000 workers in this country loses on the average about nine days each year on account of sickness. Placing the loss in wages at $2 a day and the cost of medical attention at $1 a day, the total loss to the wage earner of the Nation would approximate three-quarters of a billion dollars annually. To this should be added the economic loss resulting from invalidity and death and the loss to industry on account of decreased efficiency due to partial disability. To this should also be added the tremendous sums that are being spent by States, communities, municipalities, and volunteer organizations for the support of charities, free clinics, and hospitals and the like. When all expenditures are taken into consideration the estimate of $750,000,000 seems a conservative estimate indeed.

These cold calculations of cost, however, neither depict real conditions nor do they represent the real attitude of the American public toward such a situation. The generous response of the American public to the necessities of sufferers in the European war is striking evidence of the willingness of the public to deal promptly and efficiently with a situation when once its significance is understood. It needs only to be brought insistently to public attention that in this country the annual loss of health and lives among our industrial workers is not far behind that caused by the greatest war in history. To inform the public of such a situation is clearly within the province of the State health agencies.

Economic factors increase health hazard.—It is not necessary to inform health officials of the character and extent of the conditions which have caused such a situation, but it is doubtful if the underlying economic factors have been adequately analyzed, especially from the standpoint of responsibility for disease-causing conditions. Without going into detailed statements, it may be said that among the more important of these economic factors are occupational hazards, irregularity of employment, unhealthful conditions of living, the employment of women in industry under modern conditions of work, particularly of married women, and the economic disadvantage at which a considerable proportion of wage workers and their families are placed as the result of low wages and insufficient annual income. A number of recent investigations have shown that these factors are important underlying causes of

disease. Any adequate remedial program must fix the responsibility for these conditions in order to arrive at a proper basis for efficient measures.

Responsibility for conditions causing disease.—In a general way it may be said that there are three groups which are responsible for conditions that affect the health of the wage earner—employers, employees, and the community. The employer's responsibility is largely limited to places of employment and conditions of work. The public's responsibility is limited in great measure to community conditions or conditions common to all groups of citizens. To the individual wage earner is largely left the responsibility for the healthfulness of the conditions under which he and his family live, but it should not be overlooked that under present conditions he is often handicapped by the effects of his occupation and of unhealthful community environment. This is a responsibility which a considerable proportion of wage earners are financially unable to meet.

These considerations—the presence of economic factors and the financial inability of so many wage earners to maintain a healthful standard of living—clearly indicate the necessity for a health program which will coordinate the efforts of all responsible groups and of the numerous health agencies at present working too independently in their respective fields.

Advantages of health insurance.—The experience of foreign countries and a study of the situation in this country have shown that such a coordination of effort may be possible in a governmental system of health insurance if properly adapted to National or State governments. By providing for the insurance of all workers adequate relief will be afforded to even the lowest-paid worker.

The joint contribution of employers, employees, and the community to the support of a health-insurance fund will give to each group a financial incentive to lessen the cost by the prevention of disease, since a definite money valuation would be fixed upon each day of sickness.

By providing medical service, with a continuance of a substantial portion of his income during sickness, the wage-earner's family would not be rendered destitute when he stops work on account of sickness and he himself could receive prompt treatment and not be compelled to continue at work until his health is seriously impaired.

Maternity benefits are calculated to conserve the health of the mothers and lower the infant-mortality rate.

The joint provision and control of the fund by employers, employees, and the community will prevent any taint of charity or paternalism, afford a basis on which capital and labor can work together for a common end, and stimulate a spirit of cooperation in the movement for improving the welfare of the wage-working population in every industrial community. Just as the workmen's compensation laws have brought about the nation-wide "Safety first" campaign, so may we expect from the enactment of health-insurance laws a movement for better health that will be intelligent as well as popular.

Relation to medical profession and health agencies.—As stated above, the local administration of health-insurance funds is usually left to local boards created for this purpose, or to trade-unions, industrial establishments, or societies which have been approved by the central governing board or commission. The German act has left the administration of the medical benefits to these local bodies, and this has resulted at times in restricting the insured persons' choice of physicians to a limited number of contract doctors employed by these local agencies and thus caused so much friction as to result in a "doctors' strike." The English act, in the effort to remedy this defect, permitted free choice of physicians registered on the panels of the funds but did not place proper restrictions upon the signing of certificates admitting insured

persons to benefits. The result was that the physicians were entirely too complaisant in signing certificates and the funds were subjected to improper drain.

In the bill for health insurance that has been introduced in the several State legislatures the German plan has been followed and the matter of providing medical benefits has been left in the hands of the local bodies and no provision has been made for correlating the system with existing health agencies. These are serious objections, since without such provisions a health-insurance law will have little value as a preventive measure, although it may meet with the approval of those who advocate it as a relief measure.

There must be a close connection of the administration of any health-insurance system with the health agencies of the country and with the medical profession. It is believed that this can be done in three ways: (1) By providing efficient staffs of medical officers in the Federal and State health departments to carry into effect the regulations issued by the central governing boards or commissions; (2) by providing a fair and sufficient incentive for the active cooperation of the medical profession; and (3) by providing for a close cooperation of the health-insurance system with State, municipal, and local health departments and boards.

Corps of full-time medical officers.—In view of the experience in both Europe and America, it would seem best to place the administration of the medical benefits directly under governmental agencies and to insert a provision that no cash benefits be paid except on the certificate of medical officers of the national and State health departments acting as medical referees under the regulations of the central governing board or commission. Such medical officers should be selected according to civil-service methods. Since these officers are the representatives of the health departments in the funds, their selection and appointment should also be based upon their knowledge of preventive as well as of clinical medicine. After a probationary period of service satisfactory to the health administration they should be given permanent appointments subject to removal only for inefficiency or immoral conduct. One of their duties should be to examine each disabled beneficiary and keep themselves informed as to the progress of his recovery. It is needless to say that the referees should not be permitted to engage in private practice.

Free choice of registered physicians.—With such a check on the payment of cash benefits the medical and surgical treatment provided for beneficiaries could safely be left to the physician of the patient's choice and payment made on a capitation basis, regardless of whether the patient was sick or well, after the manner of the English national insurance act. This method of selection and payment of physicians for the medical and surgical relief would offer every incentive to them to keep their patients well and to endeavor to please by rendering their most efficient service.[1]

Health insurance a measure for prevention of disease.—The greatest value of such a system of administration of the medical benefits would be in the organized corps of medical officers and of attending physicians registered on the panel and in the opportunity it would offer for preventing disease among the insured persons and their families. It would be through the corps of full-time medical officers of the health department acting as referees that the health-insurance system would be linked up with other health agencies. It is not necessary to relate here the advantages which would arise from the visits of such specially trained men into the homes of all sick persons. Nor is it necessary to tell how these officers, acting as health officers, could further lower the sick rate. The objection could not be raised that such a corps would be too

[1] New paragraph inserted here by amendment. See p. 26.

expensive. It would not require more than one such medical officer to every 4,000 insured persons, and at that rate they could more than save their salaries by relieving insurance funds from paying unjust claims. Furthermore, while an estimate can not be made of the amount to be saved by their efforts in the way of lowering the sick rate, it is safe to say that it would amount to many times more than the sum of their salaries.

Health officials should realize now the necessity for correlating the administration of the medical benefits of any proposed health-insurance system with existing health agencies. If health departments are at present inefficient, they should be strengthened and made adequate to meet all demands.

To enact a health-insurance law simply as a relief measure without adequate preventive features would be a serious mistake, but with a comprehensive plan for disease prevention there is every reason to believe that it would prove to be a measure of extraordinary value in improving the health and efficiency of the wage-earning population.

RECOMMENDATIONS.

The following fundamental provisions should be embodied in any health insurance measure proposed for National or State Governments:

1. *Insured persons.*—Every person engaged in a gainful occupation and earning less than a specified annual income, say $1,000, should be entitled to the benefits provided under the law. Every person earning more than the specified annual income should be allowed to qualify for the same benefits or greater benefits according to annual income.

2. *Funds.*—To be provided jointly by contributions from employees and employers; the Government to appropriate for the expenses of supervision and administration.

3. *Benefits.*—The following benefits should be provided:

(*a*) *Cash benefits.*—Weekly cash payments in case of disability due to sickness, nonindustrial accident, or to childbearing by the beneficiary for a period not to exceed 26 weeks in any one 12-month period.

(*b*) *Death benefits.*—Cash payment (for funeral expenses) to legal heirs for death due to sickness or nonindustrial accident.

(*c*) *Medical benefits.*—To include adequate medical and surgical care, medicines and appliances in home, hospital, sanatorium, dispensary, or physician's office, beginning with the first day of disability, whether due to sickness, nonindustrial accident, or to childbearing by the beneficiary or the wife of the beneficiary, and limited to a period of 26 weeks in one 12-month period.

4. *Administration.*—All matters of promulgation of rules and regulations and appeals should be vested in a National or State commission created for this purpose. All matters of local administration should be vested in local boards of directors, federated according to districts, subject to supervision by the central authorities, and rules and regulations promulgated by the commission.

The commission and all local and federated boards should be composed of persons representing the contributors to the funds. The number representing employees and employers should be in the same ratio as their respective contributions.

Provision should be made for free choice of any physician registered on the local panel, and all persons licensed under the laws to practice medicine should be allowed to register on the panels.[1]

[1] This paragraph amended. See p. 26.

A corps of full-time medical officers should be provided within the National or State health service to have supervision of all hospital and dispensary relief; to examine all insured persons claiming to be disabled, and issue certificates in accordance with the regulations promulgated by the commission; to advise the administrative authorities and all contributors to the funds as to the best measures for the relief and prevention of sickness; to advise with the physicians attending sick members as to measures which will shorten the periods of disability; and to perform such other duties as may be fixed by regulations.

Respectfully submitted.

W. C. WOOODWARD, M. D.,
Chairman.
B. S. WARREN, M. D.,
Secretary.

I move the adoption of the report.

(The motion was seconded.)

The SURGEON GENERAL. The report of the committee is open for discussion.

Dr. SAWYER. Mr. Chairman, I am very much interested in this report, because in California a social insurance commission is studying the subject with a view to introducing, perhaps at the next session of the legislature, a law providing health insurance.

I agree with the report almost in its entirety; yet there is one vital point with which I most heartily disagree—the attitude toward the free choice of physicians. It seems to me that it is inconsistent for us to argue for full-time health officers and efficient service, when at the same time we are advocating a lowered system of efficiency for health insurance.

The recommendation here is that the insured person should have free choice of any physician registered on the local panel and that all persons licensed under the laws of the State to practice medicine should be allowed to register on the panels. If generally followed, this provision would dash to the ground at once the hope which some of us have in California that through health insurance we shall at last get our medical men classified so that the public to a greater degree can receive the services of the best and will have a method of knowing who the best are. I think it will be admitted by nearly every one here that the laws for licensing physicians in the various States have in part failed, since the standards are still so low that many men are practicing medicine who are not qualified to do so. Such men should never receive the funds which are paid in for health insurance, because they can not earn them. Having failed through direct legislation to raise the standards of the medical profession to a reasonable height, we are hoping that through social insurance, by giving a certain amount of choice to the groups of people who will administer and pay for the insurance, we shall be able at last to classify our medical men and leave out of the panel

those who are not fit to take care of the people under social insurance. So, personally, I advocate at least a partially closed staff.

I wish to advocate also the institutionalizing, so far as practicable, of the whole administration of the care of those insured under such a law. I believe that we should have district centers in which there shall be hospitals, dispensaries, and administrative offices for the care of those within the district. I know from personal experience that much money could be saved through the increased service which selected medical men could give if the patients to a larger extent went to the physician instead of the physician's going to the patients.

The basis for this opinion is the result of an experiment which Dr. George F. Reinhardt carried out at the University of California. For three years I was connected with the students' infirmary which he established. We did not go out more than once or twice a month to the houses of patients, but we received 20,000 visits in a college year in the dispensary and had several hundred bed cases. In return for a small annual insurance fee the students received surgical, medical, and hospital care, and now I learn that the university has furnished dentistry at a low cost under the system. The university public were getting a low insurance rate, and one reason was that they were doing the traveling. If a person was sick we could better afford to pay for an ambulance to bring him to the hospital, so that we could examine him in the dispensary and admit him to the hospital if necessary, than to send a high-grade medical man out to that patient's home.

Of course, in our rural communities there will have to be men attached to the staff to do the traveling, but I believe that our best men should stay in the institutions so far as possible, should have large numbers of patients coming to them, and should have the assistance of a large corps of nurses and other skilled people serving at lower salaries than physicians. In this way the medical expert should be able to multiply enormously the amount of work which he can do and should always be working under conditions which allow a large play of judgment. The large amount of money and time which is spent in traveling and in social conversation with patients under the present competitive system could thus be saved, but would be wasted under the clause to which I object.

Under the plan proposed by the committee we would hire full-time referees to check the more or less competent men who would be chosen by the patients on the basis of personality, the recommendation of neighbors, or any other element which now enters into our basis for choice in the present plan of competitive practice.

The method which I have advocated would permit of specialization far more than would the method of free choice of physicians. I think a patient should come to an institution and should ask for what

he needs. He should be assigned by an administrative officer to the person who can give him what he needs. We should have under one roof groups of offices, including record rooms, medical and surgical consultation rooms, X-ray rooms, laboratories, dental departments, and eye departments. Even if we do not have full-time men for all of these specialties, we could have definite hours which they could devote to the work. In this way I believe we can save much more time and money in shortening periods of disability than if we let any physician treat the sick, and at the same time employ expert men to keep the physicians from being complacent and approving the payment of sick benefits to people who are ill longer than they need be.

There is one more point I wish to bring out. It is not original with me, but I think it is important from the public health viewpoint. It is the relation of health insurance to tuberculosis. If I am not mistaken, the report of the committee makes no special provision in this regard. I believe that we should extend or remove the time limit for benefits in this disease. We should insure in such a way that, if a person comes down with tuberculosis, his benefit will extend as long as he has the disease, because it is one of the biggest risks which the worker faces and he should be protected independent of charity. One of our prominent physicians in California advocated, a short time ago, separate insurance against tuberculosis; but I believe that is undesirable, because the whole matter of insurance should be under one act.

Dr. BRACKEN. Mr. Chairman, this is an excellent report. I had no idea that there was a possibility for such insurance in this country.

Certain European countries have taken a long step forward in these matters. They have made some mistakes which it should be possible for us to avoid. It is unfortunate that we must do everything through the States; but if some ideal scheme is presented, it is to be hoped that the various States may be persuaded to follow it closely in framing their laws bearing upon this subject.

I presume that in formulating this report the committee has taken into consideration the work of the committee on social insurance of the American Association for Labor Legislation. The recommendations of this committee are very much in line with those presented in this report. As I remember, in the model bill prepared by that committee, it is proposed that the employer shall pay two-fifths, the employee two-fifths, and the Government one-fifth. In the present report the recommendation is that the funds shall be provided jointly by contribution from employees and employers, and that the Government shall appropriate the expense of supervision and administration. I think that is an excellent idea, because those who are contributing their money sometimes object to having it used for

administrative purposes. With this provision their money is used purely for insurance purposes.

Dr. McLAUGHLIN. I have been very much impressed with this report, Mr. Chairman, and am heartily in sympathy with all of its fundamentals. I do not believe that it goes sufficiently beyond fundamentals to have us quarrel over details.

I appreciate very much what Dr. Sawyer said in regard to having incompetent medical officers kept off the panel. There is danger, however, of placing too much restriction on the choice of physicians, such as having the administrators select the specialists who are to treat the insured. There would never be a chance of getting such a bill through in Massachusetts, and probably not in other States. But I think that we can safely leave this matter to the future, permitting the details to be worked out by the local organization which has charge of the district.

In Massachusetts we introduced a bill this year which, unfortunately, gave the impression that it was of the genus "high brow," and was being pushed by a class called professional uplifters. That also means disaster for any bill; and I just want to sound this note of warning, that if we hope to get this legislation through—and I know we all hope to get a health-insurance act through—we must convince the labor unions and the labor authorities that it is their bill. If we go to the general court or to the legislature first and try to get an act passed, or "rammed down the throats" of the labor unions, as they express it, they will fight it, and of course it is impossible to get it through in the face of their opposition.

I think it is quite possible, with a little more education, to get the labor unions and the labor authorities in the States to push actively such a measure as this; and when we do, I feel sure that its success is certain.

Dr. SWEET. Mr. Chairman, I should like to ask Dr. Warren how the work of the health-insurance physicians in England and Germany is correlated with that of the existing health agencies.

Dr. WARREN. Mr. Chairman and gentlemen, less than 10 years ago a small group of people got together and started the movement for workmen's compensation laws in the United States. At that time it was not expected that much would be accomplished for years to come. Now 34 States and Territories have workmen's compensation laws which provide for accidents. At the time there was much opposition to this movement on the part of the business interests of the country; now for the most part these same interests are pleased with these laws and they are adjusting themselves to the changed conditions and have organized the "Safety-first" movement which is now nation wide.

This progressive movement has now reached the field of health insurance. To some it may seem rather ideal. Some may call it paternalistic, some socialistic, but it is neither. It is strictly a business method of providing for what is sure to come to every person—sickness and death.

The fact that health insurance is coming may as well be conceded. It is coming before we realize it. It may not come until the economic pressure becomes so acute as to compel action, or it may be that the lawmakers will be farsighted enough to anticipate such a condition and enact the laws at an early date.

With this in mind, health authorities should be prepared with workable plans whereby they can be fitted into health insurance systems to the best advantage to the public and not wait until plans are definitely fixed which will leave out of consideration the public health aspect of the subject.

This brings me to the answer to Dr. Sweet's question. In Germany the law provides that the medical benefits be administered by the "carriers" or federation of carriers. The carriers are the local administrative agencies and, while subject to governmental supervision, are not really governmental bodies. The law provides that the relations between carriers and physicians shall be regulated by written contract and that the carriers, except in urgent cases, may decline to pay other physicians. The law further provides that, if it does not seriously add to the expense of the funds, members shall be given the right to choose from at least two physicians. Under this law, contracts may be made with medical societies, groups of physicians, or with individual physicians. No provision is made for coordination with the health department.

The health insurance funds have, however, realized the necessity for spending money for disease prevention and are now utilizing other health agencies in order to promote the health of their members.

In the English law the only health agencies recognized are found in the chapter which makes provision for the inauguration of comprehensive plans for the care of the tuberculous members. Several counties and county boroughs have adopted these plans and are doing great work in preventing tuberculosis. In no other respect is there any effective provision made for coordinating the health insurance system with the health departments.

Under the plan recommended by your committee, the matter of free choice of physician may be left to the insured persons. I believe, if provision is made for proper hospital and dispensary care, that in the long run insured persons will prefer this method of treatment, so that we may safely count on securing the most scientific medical service at a cost within the means of the lowest paid workers.

This would necessitate a provision for a "panel" composed of all legally qualified physicians who cared to register thereon, and in addition there would have to be provided by contract or otherwise a system of hospital and dispensary units for those who preferred the latter method of treatment.

To leave the matter of medical benefits to the local insurance agencies to be provided for by contract with individual doctors would be a blunder. Such a plan may be expected to obtain, in far too many cases, the doctor who is willing to underbid others in order to secure the contract and afterwards neglect his patients. Furthermore, such doctors are usually poorly qualified for their work. However, it is not necessary to relate here all of the objections to contract or lodge doctors as usually found in the experience of this and foreign countries.

As stated before, the German system provides for medical service by the contract method. This caused so much friction that a "doctors' strike" resulted. The doctors organized into what is known as the "Leipzig League" and raised a fund of several hundred thousand dollars with which to fight this method of medical relief. The strike was partly settled in the early part of 1914 by a compromise known as the Berlin agreement, but it is not permanently settled.

I feel sure that people in the United States would not long submit to this method of treatment, which would too often result in providing a "cheap" doctor willing to underbid to secure the contract.

In England, to avoid this very condition, the British Medical Association among others made the demand that free choice of physicians be provided. This demand was met by providing that medical benefits should be administered by county or county borough governmental committees independent of the local funds or "approved societies." These committees are by the law empowered to provide a panel of physicians consisting of all legally-qualified physicians who wish to register on it. From this panel the insured person has the right to choose.

The result is that over 20,000 out of about 25,000 doctors in England have registered on the panels.

The defect in this system was that the signing of the disability certificate was left to the physician of the insured person's choice. This has resulted in an unfair drain upon the funds, for it must be stated that the doctors have been entirely too complaisant about signing these certificates. To remedy this defect, some committees have appointed medical referees to investigate doubtful cases and to sign the certificates prior to payment of cash benefits. This method has worked out satisfactorily where it has been adopted.

This experience has caused me to advocate the incorporation of this plan into any system proposed for Federal or State law, and I

was glad that Dr. Woodward agreed with me that it would provide a workable plan whereby free choice of physicians could be provided without encouraging malingering.

This plan also provides an excellent opportunity for linking up the health departments with health insurance systems, by the provision that these medical referees be skilled sanitarians detailed from the health departments to issue certificates in accordance with regulations promulgated by the health insurance commissions. These all-time medical men would have to see and keep in touch with all sick insured persons. This would mean the attendance of two medical men (one skilled in preventive medicine, the other skilled in clinical medicine) upon every sick person. It is not necessary to point out the benefits of such a practice, they are too obvious.

Dr. WOODWARD. Mr. Chairman, the suggestion made by Dr. Sawyer with respect to the removal of the limitation of time in cases of tuberculosis is very alluring. We may fairly ask, however, why we should not remove the time limit with reference to all diseases. It is as reasonable to ask with respect to one as with respect to another, and the mere fact that there are larger numbers of tuberculous patients who may seek benefits does not justify a discrimination in their favor. Personally, if it can be worked out upon a financially sound basis, I should be very glad to see the time limit removed altogether.

One factor which has not been mentioned and which, I think, has to be weighed very seriously in connection with the determination as to how medical benefits are to be given is the effect of legislation of this kind on medical education. Anything that is going to render the practice of medicine a less inviting field than it is now is going to do harm. That again raises the question as to how the treatment can best be provided, whether by the free choice of physicians or by institutionalizing the beneficiaries.

Personally, I think the matter will work itself out under the sickness-insurance acts very much as I think it is probably going to work itself out in private practice. We shall come more and more to institutionalize, if you will, the sick. The time has passed when any one man can claim full ability to diagnose all forms of disease, and we shall have doctors working together in groups in private practice not under the health-insurance acts exactly as we shall have them under the health-insurance acts.

Another matter has been carefully omitted from the discussion, although it goes almost to the heart of the entire matter; that is, whether sickness insurance is to be compulsory or voluntary. I do not know whether we can settle that or not. For the greatest and the most prompt success of any measure of this kind, sickness insurance must be compulsory. The persons who are most in need of a

benefit of this kind are the persons who will be the least likely, in the beginning at any rate, voluntarily to avail themselves of it. They do not foresee their needs, and the taking of even a small amount of money out of the weekly wage is a burden. Furthermore, under a voluntary system, the burden of the overhead charge in the early days will be excessive because of the small number insured and tend to discredit the plan. But it seems to me that we must get sickness insurance, whether it be voluntary or compulsory. We must get it without too much quibbling as to the details. They will have to be worked out later. I believe when we once inaugurate the measure it will grow, exactly as our educational system has grown.

There was a day, of course, not very long ago when public schools were for the poor. Now the Presidents of the United States send their children to our public schools. So, if we provide sickness insurance, we will have it extended wider and wider until sooner or later we shall have in connection with it a system of medical practice that will be similar to our educational system. But that is not going to prevent private practice. We still have private schools notwithstanding our public-school systems. Some of our best schools are private ones. The educator who is seeking an outlet for his intelligence and his energy and his ability can leave the public system if he wants to and can go into private work, and we will have the same situation with respect to the practice of medicine. But we have got to look ahead very carefully to see that we do not frame a system of medical relief which is going to prevent competent men from going into the work because either of the inadequacy of the probable compensation or of restrictions on their opportunities for personal attainment for making the most there is out of themselves and out of their profession.

(The report on health insurance was adopted by the conference. Subsequently the following amendments, offered by Dr. Warren, were accepted by the conference and the amended report adopted:

Amendment to insert after the paragraph "Free choice of registered physicians,"[1] the following paragraph:

"But in addition free choice should be allowed to those who prefer institutional treatment by a selected staff, when available; and to this end the local and federated governing bodies might even provide dispensary and hospital units, each such unit to include a staff of physicians, surgeons, oculists, dentists, and other specialists, and a staff of visiting and bedside nurses."

Amendment to paragraph beginning "Provision should be made for free choice of any physician registered on the local panel"[2] by striking out the words "and all persons licensed under the laws to practice medicine should be allowed to register on the panels" and by inserting "and provision might be made also for adequate institutional care for those who prefer this method of medical benefits.")

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[1] See p. 17. [2] See p. 18.

The SURGEON GENERAL. As this is a standing committee no action need be taken in regard to appointments.

Dr. WOODWARD. Mr. Chairman, on behalf of the committee I ought to thank Dr. Warren and say that the report is largely his work. I think there is no one in the country who is better fitted to speak on the subject than is Dr. Warren.

I move that the following resolution from the committee be referred to the committee on resolutions:

The committee recommends that the Federal and several State governments, in order to obtain a basis for intelligent legislation with respect to health insurance, cause careful investigation to be made of industrial health and economic conditions existing within their respective jurisdictions.

The SURGEON GENERAL. If there is no objection, the resolution will be referred to the committee on resolutions.

PELLAGRA.

I should like to ask Dr. J. A. Hayne to give the report of the committee on pellagra.

Dr. HAYNE. Gentlemen, I regret exceedingly that I have no set report to make on the subject of pellagra. I had conferences with one member of the committee, Dr. Goldberger. I have had no opportunity to confer with the other member of the committee, Dr. Galloway, the former State health officer of Mississippi.

I think the committee can agree a little better, possibly, than they did last year. You may remember that then the members of the committee each held diametrically opposed opinions. This year two members of the committee agree—Dr. Goldberger and Dr. Galloway. The chairman of the committee, though, stands among the irreconcilables, who can not accept diet as the sole and only cause of pellagra.

In justice to the other members of the committee I therefore could not, as chairman, make a report for that committee. I had hoped that Dr. Goldberger would be here and would be able to make a majority report for the committee. As you all know, there has been a great deal of good work done this year on the study of pellagra, especially the work done by the United States Public Health Service.

Dr. Goldberger asked me the other day how far I could go with him, and I told him that I could go as far as believing that if a person who has pellagra is given a proper, well-balanced diet, with hygienic surroundings, he will get well; that if a whole community is kept in that condition, well fed, properly housed, and given sanitary surroundings, they will not develop pellagra; but when it came down to saying that I believed that the sole and only cause of pellagra was some vital element, or whatever you may choose to call it, either lacking or present in the food, that it was due to excess of

proteids or lack of proteids or any of those propositions, I could not accept it.

Conclusions published in the Journal of Infectious Diseases for May, 1916, covering a national study of the disease, give my present idea in regard to it. They read as follows:

More than 78 per cent of the patients had associated with other patients before they developed the disease. Thus 33 per cent of the pellagrins developed the disease in houses which contained other cases, while in most of the remaining instances there were patients in the adjoining houses or within the same block with whom they came constantly in contact.

The water used was derived from various sources; it can, therefore, hardly be considered an important factor in the development of the disease.

White and colored races appear to be equally susceptible. More white people than colored people develop the disease in the spring. The reverse holds true for the summer months. The mortality appears to be greater in the negro race. Relatively few cases were found among negro children. Individuals from 10 to 20 years of age are less susceptible than at any other period of life. Women 30 to 50 years of age are from three to four times more susceptible than men. Over 50 years and under 10 years both sexes are equally susceptible. In the rural district surveyed more men than women were affected.

The diet contains an excess of carbohydrates, but 68.8 per cent of the patients gave histories indicating that they were consuming proteins in considerable excess of 40 grams a day, an amount which has been shown to be sufficient to sustain life without the development of pellagra.

There are also some studies in regard to the finding of the bacillus Welchii in stools of pellagrins by William H. Holmes, of Chicago, which also seem to point somewhat to the infectiousness of the disease.

In our own State, of which I am able to give the statistics, we found some exceedingly great surprises this year, both in the distribution of the disease and in the fact that our preconceived notions in regard to it were proved to be erroneous. For instance, we were led to believe that the disease occurred principally in mill villages in the upper or mountainous portion of the State. We were led to believe that it did not occur in the cities but was more a disease of the rural communities. As a matter of fact, Charleston, S. C., which is the largest city we have in the State, had 185 deaths from pellagra, which gave it a rate of 208 per 100,000 of population. Charleston, as you probably know, is a very closely built town. It has more people per acre than any other city in the South unless it be New Orleans, and the poor and rich live close to each other on account of the arrangement of the city. The next county to Charleston was Sumter, which is just midway between Charleston and Greenville, and the next one was Greenville. County rates were from 208 per 100,000 down to 32 per 100,000.

There were 1,475 death certificates signed by physicians for the year 1915 in South Carolina, which is a very large number. Tuberculosis has a death rate of 123.8 per 100,000, and pellagra one of 3 per 100,000. The only other diseases that come between are dis-

eases of the kidneys and diseases of circulation; so that of the definite diseases pellagra stands second to tuberculosis in the State.

We have endeavored to take advantage of the work done by the Public Health Service in regard to the prevention and treatment of the disease, and we are now doing community work in various parts of the State, emphasizing the necessity of sanitary surroundings and proper food. We tell them that if they will keep a cow, eat eggs and a proper amount of meat, have a sanitary privy and good water supply, the probabilities are that they will escape pellagra and tuberculosis and typhoid fever.

Dr. KERR. Mr. Chairman, it may be remembered that last year this committee was appointed by reason of some little disagreement. It seems hardly necessary for me to mention the different points of disagreement.

Though I have not engaged in them myself, I have been in very close touch with the pellagra studies, and I hoped that the committee would be able to combine on an earnest recommendation to the members of the conference who come from States where pellagra prevails in considerable numbers—and, indeed, from all States, because it appears in all States—to accept provisionally the statement that pellagra is due to an unbalanced diet, at least to the extent of advising physicians and those who suffer from the disease to try a balanced diet. It certainly is not an unpleasant prescription, and I feel that sickness and deaths will be reduced by that means. We can then wait for what future investigations will bring forth.

Last fall, in a small mining community in one of the southern counties, I met a physician who had about 40 cases of pellagra during the summer. They had all been cured. His method was simply to feed them.

I think that the best result we could hope for would be to give the dietary hypothesis a thorough trial. The Public Health Service is doing that now, I think. We have three orphanages where are housed approximately 700 children. We have 145 insane persons in a similar experiment; also 38 persons who were working in the mills have come to us because they had pellagra, and they have eaten one square meal a day and have recovered; this without interruption of their employment. We hope to continue this experiment, as well as other more technical experiments.

Dr. GARRISON. Mr. Chairman, I like the suggestion just made. The physicians over the South are still at variance with reference to the etiology of this disease. At the meeting of the Southern Medical Association last fall Dr. Freeman very ably represented Dr. Goldberger in his absence with a paper on pellagra; but after having read it he had to leave, and when the discussion was opened it seemed to me that 95 per cent of the physicians present were imbued with the idea that pellagra was due to an infection. They

began to criticize and condemn most severely the Public Health Service and health authorities for publishing in the newspapers the statement that it was of dietary origin, putting forth a good many arguments against such a statement. Among other things, they brought out the fact that for a long time we had taught that malaria was due to bad air, and after we discovered that it was infectious we had to disabuse the minds of the people of the idea that it was not infectious before teaching them that it was transmitted by the mosquito.

It seemed that there was no one there to take the part of the Public Health Service or health authorities, so in defense I took this position: That no one had offered anything in the way of treatment that was worth while except a proper dietary or properly balanced diet; that no one had offered anything as a prophylactic measure that was worth while except a properly balanced diet; that in Arkansas we had been carrying on a campaign for diversification of crops and intensification of farming and had been using the theory that pellagra was caused by an unbalanced diet to secure a diversity of crops. In so doing I felt that, if we could teach the farmer to have his own cow, his own milk, and his own butter, raise his own vegetables, have his own meat, and live at home, the results accomplished would be worth while. I felt that the dietary treatment of pellagra should receive indorsement from the doctors from that point of view.

I should like now to see this body go on record as indorsing such a movement, because we have a good deal of opposition. I find that the physicians in Arkansas who try out this method almost invariably say that it is the only method that offers anything, and I think a great many of them are in favor of the dietary idea at present. But certainly at the meeting of the Southern Medical Association in that particular section there were some several hundred men 95 per cent of whom must have been opposed to the dietary theory.

Dr. RUCKER. Mr. Chairman, it is a remarkable thing how history repeats itself, particularly in medicine. Many of you may recall that a great many years ago there was much argument as regards the infectiousness of cholera. The medical profession at that time divided itself into three schools. We had first of all those who were in the minority, who believed in the infectiousness of cholera. Then we had another school, which was in the majority, that believed in the noninfectiousness of cholera. Then we had a school that chose a middle course, the contingent contagionists. They believed that cholera might, under certain circumstances of terrestrial magnetism and other unknown factors, assume a contagious character. But the work of Snow and Budd and others proved that, though the disease

might possibly be conceived as being noncontagious, or contingent contagious, or even contagious, if you kept the discharges of the sick from the mouths of the well you stopped the incidence of cholera. And so, on that basis, cholera was controlled.

Now, it seems to me that in the case of pellagra we have a somewhat similar circumstance to that related by Manson with regard to hookworm disease in Trinidad. In his lectures which he delivered at the Cooper Medical College, in San Francisco, he said that at that time there was an Englishman living in Trinidad who employed a large number of coolies, among whom there was much tropical anemia. This man, like a great many other people, believed that it was something which rose from the earth which had to do with the disease, and he observed that those men who wore shoes did not get hookworm disease. So in his travels he hit upon a scheme. When in search of health he went over to the Schwarzwald, in Germany, and there he observed the way they prepared geese for the market. He found that before the farmer took his geese to market he provided each goose with a neatly fitting antiseptic sock which would resist the road. The way he did it was to drive the geese through a trough full of tar and out on the sand. Then the geese were shod and ready for the road. This man resolved that he would try it with regard to his coolies, so each morning he made them step into a bucket of tar and out on the sand, and he immediately stopped tropical anemia among his coolies.

Now, we know, though we may quibble about the finer points of contagiousness or noncontagiousness or contingent contagiousness of pellagra, that if we feed pellagrins they get well, and that if we feed well people properly they do not get pellagra. And so it seems to me that we should agree upon this point, at least, and carry it forward in our propaganda, remembering all the time that when health officials disagree people die.

MORBIDITY REPORTS.

The SURGEON GENERAL. We will next take up the subject of morbidity reports. Dr. E. G. Williams is chairman of the committee.

Dr. E. G. WILLIAMS. Mr. Chairman, I think that all the members have copies of the report, which I am indebted to Dr. Trask for fixing up for the committee. These matters are presented for the consideration of the conference:

I.

COLLABORATING EPIDEMIOLOGISTS.

Which plan is to be preferred:

(*a*) To appoint collaborating epidemiologists, at $300 per annum, as at present, in those States where sufficient cooperation and sufficiently accurate in-

formation of the prevalence of disease can be obtained to warrant this procedure.

(*b*) To appoint collaborating epidemiologists, at a strictly nominal sum, such as $5 per month, in all the States, and also, perhaps, in the larger cities.

(*c*) To establish an area of "known disease prevalence," in which satisfactory morbidity reports are obtained currently and forwarded to the bureau, and to appoint collaborating epidemiologists only in the territory included in this area.

II.

MODEL LAW FOR MORBIDITY REPORTS—CHANGES SUGGESTED.

Add the following to the list of notifiable diseases: Erysipelas; influenza; all cases of poisoning, both accidental and intentional.

III.

STATE ANNUAL REPORTS OF PREVALENCE OF DISEASE.

(*a*) Can reports of notifiable diseases for the preceding calendar year be furnished by February 1? If not, why not?

(*b*) Can reports of deaths from notifiable diseases for the preceding calendar year be furnished by March 1? If not, why not?

The annual reports of the notifiable diseases for the calendar year 1915 were received from the several States on the dates shown below:

States.	Cases and deaths.	Cases only.
Connecticut	Feb. 18	
Indiana	Before Feb. 18	
Kansas	do	
Louisiana		Before Feb. 18.
Michigan	Before Feb. 18	
Nevada		Do.
Oklahoma		Do.
Texas	Before Feb. 18	
Virginia		Do.
Wisconsin	Before Feb. 18	
Wyoming	do	
Hawaii	Feb. 28	
Mississippi		Feb. 28.
West Virginia	Mar. 9	
Washington	Mar. 15	
Ohio	Mar. 18	
Oregon	Mar. 29	
Vermont	do	
New York		Mar. 30.
District of Columbia	Mar. 31	
Minnesota	Apr. 4	
New Jersey	Apr. 27 (deaths)	Apr. 4.
Maryland		Apr. 13.
Porto Rico	Apr. 14	
California	Apr. 15	
Arizona (deaths only)	Apr. 17	
Alabama	Apr. 19	
Utah	Apr. 25	
South Dakota	May 11	

(*c*) Would it be better to publish the reported prevalence of notifiable diseases as soon as the cases are available and later, perhaps when the number of deaths are available, publish a second table showing fatality rates?

(*d*) Dr. Charles V. Chapin suggests that in the annual reports of prevalence of disease published in the Public Health Reports mortality rates for the notifiable diseases be added to the tables. These rates have not previously been given.

Dr. Chapin's argument in favor of this is that the Census Bureau does not publish these rates until about a year later. The census rates, however, would differ from those computed from the figures furnished by the registrars.

The SURGEON GENERAL. I will call on Dr. Kelley to open the discussion of this report.

Dr. KELLEY. Mr. Chairman, one of the most serious problems which we have to settle in taking up the question of morbidity reports is the advisability of extending the list of notifiable diseases. There are three fundamental principles, I believe, that should be considered as justification for requiring reports of diseases.

First, certain reports (*a*) for use, you might say, in an emergency, or (*b*) for use in an attempt to keep out a disease which is extremely rare and which there is every likelihood of being able to control if it is promptly detected. Everybody will admit that in a disease of type (*a*)—take typhoid as a typical example—a disease against which we can do emergency work promptly, the report is entirely necessary. For the other type (*b*) you might cite Asiatic cholera, an exotic disease, where notification of the first case would be all important.

The second fundamental group is one in which the work of the health authorities represents a long drawn out struggle, with the end not yet clear, the means not yet clear, as in tuberculosis.

The third principle would be in collecting certain data for individual diseases which we are not using at all at the present time and do not know exactly how to use in the future, but concerning which we believe it would be a good thing to have some information available. It is a very easy thing to go on from that and in the light of such subjects as health insurance, to argue the advisability of general morbidity reports—reports in all cases of sickness, which would be the ultimate, final desideratum.

But, taking it from the standpoint of practical use of the reports, I must confess to considerable change of heart as to the advisability of adding to this list of notifiable diseases. I have been responsible in the past for the appearance on that list in the model law of some of the rather infrequent diseases, and I am sorry for it.

Less than six months before my arrival in Massachusetts the State added to the list of notifiable diseases. For practical purposes I believe we would be better off if this had not been done. It is important to remember that as yet the average physician considers it a

good deal of a bore and a nuisance to report diseases, and the more detail he has to cover the less he likes it. It is, therefore, very essential that our list be so constructed that there can be very little debate as to its usefulness and as to the practical purposes it is going to serve.

For instance, mumps was added quite recently in Massachusetts. Practically I do not see where we are better off for that addition. We have added septic sore throat. I do not know who thought of that first, but I would not like to tell you what I think of him. If there is anything that is an anomaly, it is the term "septic sore throat." What does it mean? It does not mean anything. On a pathological basis any infection of the throat or fauces can be called septic sore throat. On a bacteriological basis we can say that the existence of a septic microorganism in the throat causes a septic sore throat. Any case of tonsillitis would be septic sore throat. In Massachusetts we found that an overconscientious physician would be likely to report almost anything, and a good deal of the health authorities' time was wasted in looking up these cases to see if there was an epidemic. Finally we arrived at a practical solution: We had the physicians report septic sore throat only when it was occurring in an epidemic form.

We have also included among our diseases dog bite requiring antirabic treatment. Dysentery and German measles are two other diseases on the list which we would be better off without.

Influenza is suggested in this report. I think we might as well have the disease acidosis alongside it. Put them both on the list and then see what kind of a report you get. No one agrees as to what influenza is, and I think that morbidity reports concerning it will be worth nothing. Furthermore, I can hardly see the advantage in reporting a case of erysipelas. The other class, the class of poisonings, is very different; but I think we ought to go pretty slow on this question of adding indefinitely to the list of notifiable diseases until we get to the point where we can reasonably ask the physicians to report all kinds of sickness.

The scheme of having two sets of lists, the common and the rare, and putting the rare to one side of the report, is open to the same objection of having too protracted a list for the physicians to remember.

The next point is as to the annual reports of prevalence of disease:

Can reports of notifiable diseases for the preceding calendar year be furnished by February 1? If not, why not?

That depends entirely upon the character of the regulations under which the different States work. In some States there is no reason why they can not be furnished by January 5, except, possibly, a little difficulty in getting the clerical end of it through by that time.

Can reports of deaths from notifiable diseases for the preceding calendar year be furnished by March 1? If not, why not?

That is very easy to answer. In some cases they can be; in other cases they can not. It depends upon the character of your vital-statistics law. In some States complete reports can not be sent in by that time, because there will be some late returns and some deaths where the diagnosis is doubtful; but the great bulk of the deaths could be reported by March 1. In Massachusetts, unfortunately, it is impossible to do that, because the largest city in the State has the privilege of not being compelled to file its complete death returns with the State bureau of vital statistics until May or June.

From most of the States in the registration area it would seem as if there should be no difficulty in getting approximately complete reports by March 1.

Would it be better to publish the reported prevalence of notifiable diseases as soon as the cases are available and later, perhaps, when the number of deaths are available, publish a second table showing fatality rates?

I believe it would—unless we can get fatality rates in much faster than at present.

The objection raised to Dr. Chapin's suggestion that the mortality rates be added to the annual reports of the prevalence of disease—that the census rates would differ from the figures furnished by the registrars—probably holds good to some extent. However, the returns from which the Census Bureau officials make their calculations are the transcripts of death certificates which are furnished them by the same State's authorities, and the discrepancy will be due to whether in one instance the State authority takes a contributory cause when the Census Bureau takes the final cause, and vice versa. That will sometimes make a difference of as much as 2 or 3 per cent. But, in general, I think it will be accurate enough if it is remembered that all statistics are approximate anyway. When it is considered that they are based upon an estimate of population which probably represents a percentage of error considerably greater than that involved by the discrepancy of classification, I think that there should be a degree of usefulness in getting that comparison between the average returns of morbidity and mortality sufficiently great to justify publishing them in the Public Health Reports. To be sure, so far as the death rates go, we would get them from the Census Bureau, but from a year and a half to two years and a half later, inasmuch as the 1914 statistics are not yet available. Therefore, unless there is a very distinct improvement in the speed with which the mortality tables are put out by the Census Bureau, there will be a great practical advantage in getting at least a rough, crude approximation of the mortality rates from communicable diseases published in the Public Health Reports.

Dr. SWARTS. Mr. Chairman, I agree with the previous speaker in that if we expect to obtain any success from these reports of morbidity cases they have got to be made practical. If you give a physician a list of 15 or 20 diseases, he forgets which of these to report, becomes discouraged, and fails to report even the most important ones. You ask him to report erysipelas, and he will ask, "What is the practicability of that? Why not report every infected wound as well, every case of suppuration?" It is the epidemic diseases which are of interest to the health department. During the prevalence of diseases of the respiratory organs last December, January, and February everything was reported as influenza, and yet the influenza bacillus was found in only perhaps 3 or 4 per cent of the cases.

A physician can not be coerced. He has got to be coaxed. If, as in Rhode Island, he refuses to report his birth returns, for which he receives 25 cents each, do you expect him to report influenza and erysipelas when he is going to receive nothing for it and you are going to take no action on his report? He considers that the health department is just curious about figures and statistics.

Furthermore, if you are going to include everything in the list that you would like to have, and that you ought to have, you will not only have the opposition of the profession but that of the laity. During the last session of the legislature I endeavored to secure a provision whereby all physicians should be obliged to report such diseases as the State board of health should designate. Opposition came up in the senate. There were two of the leading members of the senate who did not propose to have the board of health designate the diseases that should be reported, because there were two diseases which the board might at any time place upon the list which they did not like to have reported. They were private and individual diseases which belonged to the individual families, and these senators did not care to have them made public; and inasmuch as they were to be reported by post cards and by telephone they feared that there might be a leak, and some one might discover what was taking place. Consequently I was obliged to designate what diseases should be reported under the law instead of keeping the desirable flexibility. Fortunately I got ophthalmia neonatorum in the list, since they did not recognize it as a gonorrheal infection.

Dr. TUTTLE. Mr. Chairman, in Washington we have the flexible law that Dr. Swarts has referred to.[1] We can put anything we want on the list. I can not remember the names of the diseases that must be

[1] This law reads (Remington and Ballinger's Code): "Section 5547. The term 'dangerous, contagious, or infectious disease,' as used in this act, shall be construed and understood to mean such disease or diseases as the State board of health shall designate as contagious or infectious and dangerous to the public health." (Approved Mar. 12, 1903.)

reported in our State myself, and I do not think there is one doctor out of a hundred in the State who can tell you.

I received a letter a short time ago from the health officer at Spokane, who said:

We are willing to do everything within human power, but the city commission has refused to give me an additional clerk. Therefore I can not furnish you daily the copy of the epidemiological card relative to measles, as we are having about 500 a day. It is an impossibility to get the report made up daily. However, we will get it up as fast as we can.

Now, suppose we add influenza to the list. In January we had influenza all over the State. The health officer would have been swamped with reports of influenza. Moreover, one doctor will report getting cases and another will report none—both equally busy. We will get after the one who has reported none and ask him, "Haven't you had any influenza?" He will say, "Not a case; we have had an awful lot of grip, though."

Then this "septic sore throat." I think the term was devised by somebody for the purpose of ducking the diagnosis of scarlet fever. That is about all the use that is made of it.

We could send the Public Health Service a report on the 15th of January as far as morbidity is concerned, but our deaths we can not send until March.

As to the question of making an estimate of death rates, what are you going to base your estimate on? The Census Bureau's estimate of the population? Nearly 58 per cent underestimated in Washington in 1908, according to their own figures. To-day they are probably as badly underestimated in Montana as they are overestimated in Washington. The result is that Washington has an absurdly low death rate and Montana an absurdly high one. If we are going to estimate the death rate, let us base it on facts.

Dr. BRACKEN. Mr. Chairman, I can see only one reason why reports of notifiable diseases for the preceding calendar year can not be furnished by February 1. Sometimes it may be hard to keep up with the regular routine work, in the wintertime especially, and to get such reports out promptly enough.

Can reports of deaths from notifiable diseases for the preceding calendar year be furnished by March 1?

They certainly should be in all of the registration States, because a death certificate is given only on the issuance of a burial permit, hence the death certificates should all be in the hands of the State registrar by the 1st of February at the latest.

The recommendation of Dr. Chapin, that the Public Health Service should give us reports of deaths, is a good one.

Dr. FRANTZ. Mr. Chairman, Delaware, of course, is a small State, but it can be taken as one of the units in larger States. We have

three counties, with a population of about 210,000. We require the undertaker, within 24 hours after he receives his death certificate from the physician, to make a postal-card report of the death to the bureau of vital statistics. These go into a filing cabinet weekly, so that at the end of every week we can tell just the number of deaths from every disease. Then there are monthly and quarterly files.

In Delaware we have a different system of registration; that is, the death certificate does not come to the bureau of vital statistics until the end of the quarter. The local registrar in each district (there are nine local registrars) is required quarterly to make three copies of his death certificate—one copy for his own office, one copy for the recorder of the deeds of the county in which he is registrar, and one copy for the bureau of vital statistics. At the end of the quarter we check up the postal-card report from the undertaker with the death certificate. At first we had a little trouble with the undertakers; but to-day we are getting 100 per cent of the deaths of Delaware. They are all recorded systematically and an index is made out yearly for the bureau of vital statistics and for the recorder of deeds.

We require morbidity reports, as is usual in the other States, within 24 hours, and there is a fine from $5 to $25, as in other States, for nonreporting. These reports are filed away in filing cases, so that we can tell weekly, monthly, and quarterly just how many cases of diseases have been reported.

Are we getting full morbidity reports now? We have had this plan in operation for a year. The reports are improving each month and each quarter. Rome was not built in a day, and you can not expect to take up a proposition of this kind and right off the bat have your physicians make complete and perfect reports. I do not believe we will ever get complete morbidity reports—not as complete as death reports—but there is no reason why we should not in time educate physicians to make fairly complete reports.

There are methods of telling whether physicians are reporting. For instance, your death report comes in and you have no morbidity report for the case. You can go after the doctor and give him warning. A record is kept of these people, and if one keeps on neglecting his report, he is fined. It does not take many fines to make him report. There is no physician so active or busy that he can not sit down in the evening and make out his postal-card report.

The importance of the 24-hour morbidity report is greater than that of the death report. Why? We have up in Wilmington certain watercourses. If there is typhoid fever, the moment a case comes up we refer it to the water department and they send their men out to the watershed and see that proper care is taken of the offal.

I would not advise adding to the list of diseases at the present time.

Dr. HAYNE. Mr. Chairman, I would like to say that we do the best we can in South Carolina toward getting morbidity statistics. We are honest about it; we don't get them. We probably get as many as the surrounding States get.

As to the reporting of deaths, we are not admitted to the registration area. Why, I can not say. According to the census report, made by men whom they sent down there, we get 93.7 per cent of the number of deaths that occur in the State. They said to us that they required 90 per cent. They admitted Virginia, without any investigation whatsoever, with a showing of 14.2 per thousand of population. Our showing is 15.1 per thousand of population, and, according to the Census Bureau, our population figures are accurate. They admitted North Carolina on 9.4 per thousand of population.

We can not only give the deaths but we can give them within the dates set here. We can give them before the 18th of February for the preceding year. And I agree with some of the others that those deaths should be put along with the morbidity report, because I think that it will show some very astonishing death rates.

For instance, in some reports we have more deaths than we have cases. This occurs infrequently, but still has occurred. It occurred in pellagra, where we had twice as many deaths reported as cases. And as to these other diseases, I agree with the other speakers that we should limit the number of notifiable diseases to those that the State department of health or the local board of health is going to do something about. I do not think there is any necessity for a doctor to report a disease simply for statistical purposes. A doctor does not receive any pay for it, and he has a great many things to do for which he receives no pay. He has to make out death certificates; he has to make out birth certificates; and I think he is worked hard enough without being required to report a lot of diseases about which the State department of health is going to do nothing.

Dr. TRASK. Mr. Chairman, I think that everybody who has talked on this point of the notifiable diseases has stated facts which are irrefutable and with which we all agree. I do not believe that any disease should be notifiable unless the health department intends to attempt to control it; but when it does, then the disease must be made notifiable. I can not conceive of any effective way of controlling a disease without the information that comes in this manner to the health department.

The suggestion that certain diseases be added to the list in the model law, however, referred to the model law that the conference has adopted. As regards this law, it is not expected that each State will make the diseases mentioned therein notifiable at this time, because it is well known that there are many States in which they

would not be reported. There are some States that have not the necessary machinery for properly handling these reports and using them, even if the physicians did report the cases; there are many States in which the physicians are not yet educated to the great importance of these reports; there are also many States where notification of none of the diseases is enforced, and the physicians seldom do it of their own accord.

This model law represents the consensus of opinion of this conference as to what is desirable under an efficient, adequate health department, backed by an intelligent community. This represents the model, as its name implies. The question of whether these diseases should be added really means: Does the conference consider that these diseases are preventable and that the control of their occurrence should properly be attempted by the health department; does the conference believe that, if the health department could do all the things it ought to do and would like to do, the occurrence of these diseases should be prevented by it? If so, the health department would need the information furnished by reports of cases.

Dr. FRANTZ. Mr. Chairman, I should like to say just a word in the line of Dr. Trask's thought. The immediate morbidity report gives the health department the opportunity, where they have any literature, as, for instance, in cerebrospinal meningitis, in diphtheria, in scarlet fever, in typhoid fever, and, we will say, whooping cough, to send out at once to the patient and family such literature on the subject as they may have for distribution; and I think that is one of the important matters that immediate morbidity reports will attain for the preventive medicine of the future.

Dr. L. R. WILLIAMS. Mr. Chairman, I would like to express my appreciation to the Surgeon General's office for preparing the excellent programs for these conferences. It seems to me that since I have had the pleasure of attending these conferences you have added to our discussions here a number of topics which are quite above the opportunity of the different State departments to avail themselves of at present, and I think that it is quite proper and fitting that you should do so. You have brought up this morning the question of health insurance, which may be a matter of 10 years in the future. You are bringing up the question now of morbidity reports which are not going to be adopted at once and can not be carried out in detail for some time to come. But I do not see any reason why we should criticise the suggestion of adding certain diseases to our morbidity report just because they can not be made use of at present. There are some diseases, for example, one that Dr. Kelley and other gentlemen have spoken of, German measles, a trivial disease, and yet by means of having German measles reported in New York

State we have been able promptly to control three epidemics of scarlet fever. So it is rather useful to have those diseases reported.

Another disease which is very laxly reported is chicken pox. We have required every adult with chicken pox to be visited by a State inspector and a definite diagnosis to be made as to whether it is chicken pox or smallpox. As a matter of fact, what we ought to do in morbidity reports of communicable diseases is to require only those reports where we can expect the local health officers or the State men to see that something is done to prevent the further spread of disease.

Those of you who were at the meeting of the Congress of American Physicians and Surgeons last Tuesday afternoon may have heard Dr. Hugh Cabot, of Boston, read a paper on "Syphilis and Society," in which he deprecated the reporting or attempting to report cases of syphilis, for the sole reason that the reporting of a case of syphilis to the sanitary authorities did not do the patient any good; and that remark was given very loud and prolonged applause, which, I think, shows rather well the attitude of physicians—they are thinking of their patient and of themselves and not of the prevention of disease among the rest of the community.

There is one very important thing, it seems to me, in regard to this whole subject of morbidity, and that is that we should study our reports and find out where we stand on morbidity. In New York we have been trying for the last year to find out just how many cases dying of certain communicable diseases had been reported to us during life, and we found that during 1915 of those dying from tuberculosis about 50 per cent were reported during life, and that since the 1st of January about 65 per cent were so reported. We find that the same is rather true of typhoid fever. Of the cases dying of typhoid fever about 75 per cent have been reported during life.

Then we made another study of the fatality rates of the different diseases and it was interesting, especially in the minor diseases, to find that in whooping cough and measles the fatality rate was anywhere from 150 to 300 per cent in different communities, showing that cases were reported at death and usually not otherwise. We were quite surprised to find that in two counties of the State the fatality rate from typhoid was over 100 per cent; that is, practically the only cases reported were the ones reported just as they were about to die. In diphtheria and scarlet fever, on the other hand, it is quite different. We find in diphtheria about 98 per cent of the cases that die are reported during life, and in scarlet fever we find that practically all are reported during life.

We have wanted to go further on that whole subject. For the past year and a half we have tried to send to physicians a statement whenever the rates of morbidity were high in the county, telling them

what the law was and also to send a circular letter to e
that community. We have endeavored to stimulate in
we could an interest in having these diseases reported. S
of January of this year we have had some one of our me
central office visit almost every county medical society at
ings and give a talk on the importance of reporting co
diseases. We have begun to send out official bulletins to
sician in the State (and it is quite an order to do so; ther
7,800) notifying them about the importance of reporting
cable diseases. We are now sending a special letter o
subject. We are hoping that the public health commi
State Medical Society will report a resolution in favor of
reporting cases of communicable diseases that are requi
authorities.

Then we plan, beginning on the 1st of July, actually
prosecute physicians who have failed to report cases of c
ble diseases. By law physicians are paid 25 cents apiece
ing, but I do not believe one physician in a thousand eve
trouble to collect that. At least we have never heard of a
does it. The health officer, who gets his pay indirectly, i
way, takes care that he gets his fees.

It seems to me that what we really want to know is,
do these morbidity returns mean, and how far can we go
ing up the different cases of disease?

It would seem to me that we could rearrange a good m
tables in regard to communicable diseases. I have been
surprised at the meagerness of detail in regard to va
municable diseases. For example, I read in the press so
an article which stated that deaths from diphtheria had be
increasing and that there was more diphtheria in Massach
there ever had been. That statement was ignorantly ma
there was no consideration given to the question of increa
lation in Massachusetts. Apparently the individual who
letter to the paper had found the Massachusetts figures
the cases and deaths for some years past. The only other
gives these figures in detail is Michigan.

It would seem to me to be very advisable if we could
figures giving the number of cases of different diseases re
case rates per 100,000, and the number of deaths from
diseases, and the death rates from those diseases. I do
agree with Dr. Tuttle about the fallacy of the mortality
we do not use the populations given by the Census Bur
have no mortality rates at all; let us forget the whole th
not think we can do anything better than to hope that in
the census will be taken for the purpose of finding ou

where all the people are, instead of attempting to find out the population for purposes of political representation; and when we can once get that, we will have something that will be far more accurate than what we have now.

As to the work in New York there is so much that I would like to tell you about it, and so much that is not being done, and so much more that we hope to do, that it would not be practicable to go into the whole subject with you. But I would only like to reaffirm what I said at the outset, that it seems to me that it is most important for us at these conferences to consider what can be done in the future, and not to expect to get everything done at the present.

Dr. KELLEY. Mr. Chairman, it has been really an amazement to me how well the physicians report in Massachusetts. I think a good deal of that has been due to the work of our district health officers. For example, for the entire State in 1914 there were reported 12,264 cases of measles and 149 deaths. Last year 22,356 cases were reported and 142 deaths. That is interesting in view of the figures Dr. Williams gives for New York.[1]

His statement as to the reporting of German measles being of value in checking cases of scarlet fever is a point that is probably well taken. Occasionally I think you will find that is true. In Massachusetts German measles are not reportable at all; scarlet fever is. Some of the more conscientious physicians are about as liable to report one as the other, and there is a serious drawback to repeatedly asking the doctors to add a lot of things for us in the way of reporting, when we are doing nothing promptly for the physician. When he can see what we are doing his attitude is entirely different.

In the case of diphtheria we have a different illustration. This is a way in which morbidity reports and mortality reports are interesting. Last year there were 9,330 reported cases of diphtheria and 640 deaths; for the last three or four years there apparently has been no decrease in the fatality. It is difficult to say why, because if there is any disease that we ought to be able to control theoretically, it is diphtheria; and if any State ought to control diphtheria it should be Massachusetts, where free antitoxin has been available for over 20 years and where there is every opportunity for laboratory examination. However, until recently our rate since 1912 had slowly increased.

We took this ground a year ago: That of all the communicable diseases, aside from tuberculosis and pneumonia, diphtheria was the only one that constituted a large percentage of the death rate. We have, roughly, 50,000 deaths a year from all causes. Typhoid causes 250 deaths. While that is a serious matter, the death rate would

[1] See p. 41.

be little affected by the saving of those lives. Diphtheria, st
ing three-quarters of a thousand deaths a year, however, re
something worth while to concentrate on. So we took the m
reports and death reports and made a practice of inves
every fatal case in the State, to get all the details availab
why the patient died, as to whether it was the doctor's
parents' fault, as to whether there was a contact which came
previous case that was unrecognized, etc. Some of the ph
were a little resentful at first, but they soon found out what
getting at and we have had a remarkable diminution in the
of deaths since then. How much of that is actually due
work it is impossible to say, but I have a strong feeling tha
of it is.

That is one use of mortality reports and morbidity repor
bined—to make an analytical study of diseases that ought to
vented; to go right back to ultimate causes; to take every ind
case.

In way of exonerating the name of the medical profession
rather pleased that apparently fully 80 per cent of the f
from diphtheria in Massachusetts are due to failure to ca
physician until the child is practically moribund. There is
percentage, practically 10 or 15 per cent, which comes squa
to the doctor.

Dr. WOODWARD. Mr. Chairman, I am in entire sympath
everything that has been said with regard to the desirab
following up each report of a case by action. The situa
minds me, however, of the poem concerning the young la
wanted to go to swim. She might hang her clothes on a
limb, but she could not go near the water. We are saying
must have no reports unless we are going to act. In other wo
must have the machinery wherewith to act before we have
Now, what justification can we have for demanding machin
action when we have nothing on which to act? I believe we
approach the subject from both standpoints.

I think we might emphasize that point particularly with
to cases of poisoning. That brings up a matter in which
officers generally—health officers universally, I may say—have
in their duty. We have looked on a death from diphtheria or
pox or typhoid fever as a matter worthy of notice, but we h
so looked on death from violence. We have not looked on t
ability due to poisoning or to accidents of any other kind as
of the notice of a health officer; we have not looked upon s
as worthy of notice; and the result is that there has sprung
every community a most laudable private endeavor in the
"safety-first" associations, altogether outside of our health

ments. The work that the governments ought to have taken on themselves and done, the work that governments are best fitted to do, with respect to accidents as with respect to tuberculosis, is being done by private agencies. Deaths from violence do play a very important part in reducing the population; and we can read from that the fact that nonfatal accidents play a very important part in creating disability; and anything that results in death and disability through interference with personal welfare seems to me to be properly a subject for action by the health authorities.

In fact, there is very little official machinery of any kind for a proper study of death from disability, accidents, or suicides. You will find in practically every State that where death results there is an investigation; but if death does not result (unless the accident happens to be an accident incident to the operation of some public-service corporation) nothing is done. Of course, States have required accidents to be reported where inflicted by street or steam railway companies, or in the operation of mines (properly public-utilities corporations).

So it seems to me that instead of eliminating poisoning from our list we ought possibly to include accidents and suicides as prospective members of this group. I think we are losing a valuable opportunity for reducing the death rate through a proper study of these two elements in our mortality tables which are certainly to a considerable degree preventable.

One word with respect to the incorporation of deaths in our morbidity tables. In the District of Columbia we have just entered upon a different arrangement. We have already begun a movement toward consolidating all of our morbidity statistics in our mortality tables. Why should we state in one table the number of deaths from a given disease and elsewhere the number of cases? And so the District's mortality tables are going to be gradually worked up so that if you want to find anything about diphtheria you will turn to one table, and that will give you the cases, deaths, and fatality rates.

A single word more with respect to the doctors not being paid for making these reports. Of course, the State does not pay the doctor, in many cases, for making the reports; but it is not fair to say that the doctor is not paid. The State imposes on the doctor a certain restriction with respect to how he shall practice medicine. It says to the physician, "If you attend a woman in confinement, you must make a report; if you attend a case of measles, you must make a report; if you attend a case of diphtheria, you must make a report." That is a part of his professional duty; and in theory—and in fact, if he so desires—he charges in his bill for the service rendered.

The SURGEON GENERAL. If agreeable to the conference, t
will appoint the following gentlemen as members of the c
on resolutions: Drs. Sawyer, Garrison, L. R. Williams, Ru
Tuttle.

(Thereupon, at 1.10 p. m., a recess was taken until 2.15 p.
same day.)

Afternoon Session, May 13, 1916.

REPORTS OF COMMITTEES—Continued.

MORBIDITY REPORTS—continued.

(The conference was called to order, at the expiration of t
at 2.15 o'clock p. m.)

The SURGEON GENERAL. If there are no further remarks
bidity reports, I will ask Dr. Williams to close the discussi

Dr. E. G. WILLIAMS. Mr. Chairman and gentlemen, thes
were mentioned in the report of the committee not for the pu
recommendation, but simply for the purpose of discussi
questions had been raised by different persons. Personally
in favor of adding to the list of reportable diseases. As
sipelas, we do not now have epidemics of that disease. If w
would certainly be a reflection on the surgeon or the hospital
they occurred. Influenza is too closely associated in doctor
with bad colds. Some doctors call all bad colds influenza
cases of poisoning, I do not think we should request the r
cases of poisoning. That is too indefinite. Some of the
poisoning are unquestionably medicolegal, and not health
Most cases of indigestion are poisoning, and I do not th
practicable to add them.

I want to say that the present system has worked exceedin
in Virginia. Our morbidity returns have been very valuab
instance, take typhoid fever. Last year we began noting ev
of typhoid fever that was reported. First, we would sen
doctors bedside directions, and then to the householder w
send a personal letter explaining in a simple way how typh
be carried, how it can be prevented, and what precautions s
taken. Last year we had a great reduction in typhoid fever
preceding year—nearly 2,000 fewer cases—in fact, only 41 pe
the number of cases of typhoid fever that we had seven ye
when we began getting the morbidity returns.

In regard to diphtheria, the morbidity returns for the la
years have shown that the minimum number of cases each
curred in June. October was the month with the maximum

of cases. In June we would have only about 1.2 per cent of the total number of cases in the State, or 8 per cent of the cases that we had in October. In other words, we would have twelve times the number of cases in October that we had in June. As there are only 100 cases in June, it would appear that, if in this month the proper medical asepsis could be practiced with each of these cases and with the carriers that may be located in their neighborhood, the disease should be most easily eliminated. The statistics show when the campaign should be started to be most effective and with the smallest expense and trouble.

I hope that this present arrangement will be continued. The statistics were formerly gathered by the State board of health. At first 50 per cent of the doctors reported, then later 60 per cent, and when the collaborating epidemiologist was appointed, 80 per cent reported. The franked reports have been a great help. About 10 per cent of doctors are out of place every month, and they do not send the report, either on account of sickness or being away from home; so that, with 80 per cent of the cards returned, it means that practically 90 per cent of the cases are reported.

I consider the morbidity returns a most valuable feature of our health work.

Dr. L. R. Williams. Mr. Chairman, it is quite evident to me that in discussing morbidity reports what has really been of particular interest to all of us has been the fundamental principles of the control of communicable diseases and the fact that we have utilized morbidity reports for that purpose. Now, it seems that each and every one of us would like very much to tell what our experience has been and what we are doing. There must be a great many of us who are doing things which are valuable, and it would seem to me very well worth while if we could collaborate with each other during an entire year, and endeavor to formulate some standard method of procedure in the control of communicable diseases. I would like to suggest as a resolution, therefore, that the Surgeon General appoint a committee, the number to be decided by him, to consider the standard methods of the control of communicable diseases, and to report to us at the next conference.

The Surgeon General. If there is no objection this resolution will be referred to the committee on resolutions.

New Business.

As the reports of the various standing committees have now been made, we will take up, under the head of new business, the subject of collaborating epidemiologists.

COLLABORATING EPIDEMIOLOGISTS.

Dr. TRASK. I thought that the most interesting way in w
could be handled, Mr. Chairman, would be to let each coll
epidemiologist tell briefly for the benefit of the other mem
he has done in his State.

The SURGEON GENERAL. I will ask Dr. Bracken to
discussion.

Dr. BRACKEN. Mr. Chairman, I hardly feel like takin
question by telling what the States have done, because I t
if we follow that policy, we will get into an experience me
we shall never be able to get out of; but I will say tha
laborating epidemiologists in Minnesota, we are simply
the result of the month's regular epidemiological work an
that to the Surgeon General, and that in addition we ar
him reports of smallpox, as requested, for various district

Dr. Chesley, as director of the division of preventable
has under him two epidemiologists, and he follows hi
closely, getting not only the reports of cases but also r
releases. I would therefore like to ask him to discuss the
of collaborating epidemiologist in Minnesota.

Dr. CHESLEY. In Minnesota the reports are made in c
with the instructions of the Surgeon General's office; that
Monday night there is a telegraphic report made of the n
cases of smallpox in newly affected sanitary districts.
there is an outbreak of smallpox in which fatalities occur
special telegram, which is followed by a letter giving detai
mation. Then there is a monthly report which gives the n
cases of notifiable diseases from the State as a whole.

As to reciprocal notification of communicable diseases, by
letter to the State or provincial health authority concerned
all information we can obtain relative to cases treated in
apparently infected outside the State, or which leave Minne
infectious condition, such as open cases of tuberculosis,
typhoid carriers, etc.

Dr. BRACKEN. I would like to supplement what Dr. Ch
said by stating further that we not only take the reports
sent in by physicians of these cases, but that we watch ever
clue—newspapers and letters that come incidentally to us—
whether the cases that we pick up in this way have been
regularly. If not, we follow them up, and I think there
deal of follow-up work that Dr. Chesley did not emphasiz

Dr. CHESLEY. The follow-up work relates not infrequentl
outside the State. For example, in 1914 there was a sharp
of typhoid in a small town in Minnesota. We searched

registers and sent lists of names, with the addresses given in the registers, to 18 different States and four Canadian Provinces, so that, if any of the 147 nonresidents of Minnesota who had been in that town during the time when its water was polluted should come down with typhoid fever, the local authorities would be aware of the source of the exposure. We received returns of only two cases outside of Minnesota. Through our local health officers we followed up all Minnesota people known to have been exposed. However, there were many transient workers, such as harvest hands, of whom we could get no record. It is not known whether any of them developed typhoid.

The SURGEON GENERAL. We would be glad to hear from the other collaborating epidemiologists present.

Dr. HAYNE. Mr. Chairman, so far as the State of South Carolina is concerned, I think that the plan has been of use in this way: We have used the franked envelopes to write to physicians in order to obtain morbidity reports, and they have paid more attention to an envelope with the frank of the United States Government on it than they have to the State board of health envelopes. The physicians in my State have become accustomed whenever they get any letter with "State board of health" on it to put it in the wastebasket at once without further investigation. In fact, we have gotten so that we do not use anything except plain stationery, so that there is no clue to the fact that it may be an inquiry from the State board of health. Now, when we use these franked envelopes, and put ourselves down as collaborating epidemiologists of the United States Public Health Service, they do not confuse us with the State health officers, and they very often make reply to the letter. The physicians see that it is not just an unnecessary inquiry on the part of the State board of health for morbidity statistics, but that the United States Government thinks it of sufficient importance to get these statistics to appoint a physician as collaborating epidemiologist. That makes a physician realize that the getting of morbidity statistics is a necessity for a health department, whether it be the United States health department or the State health department. I think in that way the collaborating epidemiologists have done a great deal of good. I think they could do more good if we could get better cooperation on the part of the local health boards in the cities. We get very little cooperation from them. They get reports, and get better reports than we do, but they fail to turn them in to us.

The only disease that I can honestly say that I get the reports from in South Carolina is diphtheria. I do not think that I miss in the State more than 10 cases a year, if that many. Dr. Williams has said that June was the month in which they had the least diphtheria

and October was the month in which they had the most dipl
That is true in South Carolina, except that our maximum d
occur in October. If it did occur in October we could readily
stand it, because the schools open about the middle of Sep
and there should be a rise because of contact of the children
opening of school. But our highest number of cases is from
to the 15th of September, when the schools have not opened
evidently shows that it is a seasonal incidence of the disease
not due to the gathering together of the children. We have be
to have the curve of diphtheria prevalence shown now f
years. The reason why I say that we do get those reports is
this: That we furnish, as you may know, diphtheria antitox
to everybody in the State, rich and poor, black and white, an
is no diphtheria antitoxin sold in the State at all. There is
the drug stores, except that which is furnished by the State b
health. Consequently, if a case of diphtheria occurs, the
have to go to the drug store and get the package of diphther
toxin. In order to obtain that package they have to regis
name of the child, its residence, and the physician in attendan
that way we get an absolutely accurate record. Last year we
the State 1,975 cases of diphtheria, and we had 74 deaths, wh
pretty good record. That is about as good a record as you w
anywhere.

Now, whether in all the fatal cases they used diphtheria an
or not, I do not know; but I do know that in the 1,975 cases th
reported diphtheria antitoxin was used. Whether every one o
1,975 had diphtheria or not (as a matter of personal error
part of the physician) it is impossible to say. Where one ph
will call it diphtheria another one will call it septic sore thr
another one will call it tonsillitis.

So we can not put too much dependence on our morbidity r
In the lower part of the State every continued fever is repo
malaria; in the upper part of the State every continued feve
ported as typhoid fever. Those things, of course, enter in
question. But if you find, as Dr. Williams brought out, tha
various States you can map out a curve for diphtheria, you a
ting at facts. And there must be some reason for the season
dence of diphtheria which we have not yet discovered; ther
be some reason for the seasonal incidence of malaria; there m
some reason for the seasonal incidence of typhoid fever; and a
things will have to be worked out. In other words, the mo
reports give us phenomena the causes of which must be dis
by further study.

Dr. GARRISON. Mr. Chairman, I anticipate that our work
similar in different States. In addition to making the repo

have been suggested, the collaborating epidemiologist in Arkansas sends out every month (or did until last fall) about 2,500 cards to all the physicians in the State. That is done for Dr. von Ezdorf, who is collecting some morbidity statistics on malaria for the Public Health Service. Since that time we have been sending them out quarterly.

With reference to the reciprocity idea, I received over a year ago a notice from either Minnesota or Wisconsin, I have forgotten which, that a person had developed typhoid fever a day or two after arriving there from Arkansas. The patient's residence in Arkansas was given me. No typhoid was found there, but in another community where this person had been a short time before I found nine cases of typhoid, all having developed from an imported case living on the crest of a hill, due to contamination of surface water supply. That information from Wisconsin or Minnesota was worth a good deal. I believe that we can develop the system considerably as we get our local organizations better systematized, and in that way render a great service to each other.

I see the question here, under (b):

To appoint collaborating epidemiologists at a strictly nominal sum, such as $5 per month.

Unfortunately, in Arkansas we have a very limited appropriation, due to the governor's veto; and in some instances I have had to call in extra assistants in order to get out these cards. Therefore, I would suggest that the salary be raised from $25 a month rather than cut, especially in those States which have a very limited appropriation.

The SURGEON GENERAL. I would like to say in this connection that the bureau desires to have a collaborating epidemiologist in every State, and that whenever a State adopts the provisions of the model law and notifies the bureau that morbidity statistics are being collected, it has been the custom, if funds were available, to appoint some one in the State health office as collaborating epidemiologist. This official then has the franking privilege, is given official stationery and blanks, and is required to make reports to the bureau. These reports are received, compiled, and published weekly by the Division of Sanitary Reports and Statistics.

Dr. TUTTLE. Mr. Chairman, I do not know how much our work differs from that in other States, but I do know what the collaborating epidemiologist means to us. We are now getting reports from the smallest health offices in the State, and we get them fairly promptly, whereas before we had the epidemologist's cards there were a good many of them that we did not hear from at all.

But the collaborating epidemiologist plan has done more than that by reason of the franked envelope and the official stationery.

We had a little outbreak, about eight or nine cases of diphthe
a town of about a thousand inhabitants, and I was very anxi
make cultures of all the school children's throats in that tow
did not have the money to do it with. We could furnish the
tubes, etc., to make the examination, but we did not have the
to send a man there and keep him there to collect the specimen
on this official stationery I wrote to the mayor, as collaborati
demiologist, and got an immediate reply agreeing to be
expense, whereas he had flatly refused to comply with the
commissioner's request. So it helped us a great deal in that w

What it has done in the way of reports it is hard for me
because we have really been operating only about four months
year we made a special effort on typhoid fever. In 1914 our r
show a death rate of about 20 per cent of the cases reported
typhoid fever. In 1915 we had a death rate of 13 per cent. F
first three months in 1916 we show a death rate of 11 per cent
other two years studied showed that we had a higher death
that is, we had a smaller report—in the first three months th
did later. So we hope (and we believe that we have reason
hope) that in 1916 we will show a death rate of 10 per cent or
from typhoid fever, which I believe indicates a fairly co
report.

Last year we had a very much smaller report of measl
whooping cough in proportion to the number of deaths.

The thing I wish we could have would be a franked card
doctor. If we had a franked card for the doctor, we would ge
cases that we do not get now. We understand now that only
officers can use the franked card. And I do not see, gentlem
feel that this is something that we ought to take up, although
not exactly pertain to the subject), why information on how
for the calf can be franked under this Smith-Lever bill to an
on earth who happens to be a farmer, and we can not send
baby bulletin without putting a United States 2-cent stamp o

The Acting Chairman (Dr. Kerr). Dr. Trask, have you
on this point?

Dr. Trask. I just wanted to answer that question, in order
rect any misunderstanding there might be. There is no diff
The Government official can use a frank on official business
time and any place. No one else can use a frank at any time
place, except under the terms of the law. The law reads:

Relating exclusively to the business of the Government of the United

Dr. Garrison. At the present time the Public Health Servi
a man in Arkansas making a survey of schools for the purpose
termining the percentage of the feeble-minded, and I have been
the franking privilege to notify the teachers, directors, etc., th

survey is going to be made by Dr. Treadway at such and such a time. The question was raised in the office as to whether or not I was infringing that right. I used the franking privilege and stated that he would make the survey at such and such a time, and that he was collecting the data for the Government.

Dr. TRASK. That is perfectly proper, because it is about business that Dr. Treadway was doing, and Dr. Treadway could not be doing any work for which he draws his salary unless it was work for the United States. So you, as another official of the Government, could write in regard to the work that Dr. Treadway is doing, and you would be subject to criticism did you not use the frank under such a condition as that.

Dr. BRACKEN. If the collaborating epidemiologist can write a letter asking some one to report facts to him because he is collaborating epidemiologist, the man who replies has the right to use the frank, too; that is, you give him a return envelope?

Dr. TRASK. You can give him a franked envelope, but it must be addressed to you as a Government official.

Dr. SWARTS. What is it necessary to comply with in order to have the privilege of having an epidemiologist? For instance, in our State what would you require?

Dr. TRASK. The main essential in the past has been the necessary money for the Treasury Department to pay them with.

These appointments are not made to extend the franking privilege. The moment that were done the whole thing would be abolished and, in my opinion, ought to be abolished.

Dr. RUCKER. It occurred to me that it would be a very valuable thing if I were to read the law on the franking privilege, so that there might not be any misunderstanding about it.

Paragraph 5 of section 3913 of the Revised Statutes of the United States says:

> That it shall be lawful to transmit through the mail, free of postage, any letters, packages, or other matters relating exclusively to the business of the Government of the United States: *Provided*, That every such letter or package to entitle it to pass free shall bear over the words "Official business," an indorsement showing also the name of the department, and, if from a bureau or office, the names of the department and bureau or office, as the case may be, whence transmitted. And if any person shall make use of any such official envelope to avoid the payment of postage on his private letter, package, or other matter in the mail, the person so offending shall be deemed guilty of a misdemeanor, and subject to a fine of $300, to be prosecuted in any court of competent jurisdiction.

In paragraph 29 of the same section it says:

> Any department or officer authorized to use the penalty envelopes may inclose them with return address to any person or persons from or through whom official information is desired, the same to be used only to cover such official information and indorsements relating thereto.

Dr. BRACKEN. I wish to thank Dr. Rucker for bringing fore us.

PROGRAMS OF CONFERENCES.

The ACTING CHAIRMAN. At this point there is some rather change in the program, and it might be pertinent to state subjects from now on are brought together not with the idea ing any very definite action at this time. These programs, I are made up by the officers of our service, and represent measure the subjects in which we are interested and with w are confronted. I have felt sometimes in the last 10 years perhaps missed the mark in preparing the programs, and t jects of interest to the State health departments have not been selected. I feel, though, that the subjects that are ahe are of especial interest, and they all hinge on the question shall be the powers and duties of State health authorities; words, the scope of State health departments.

The tendency in the present public health movement, an recent past, has been, it appears to me, to disassociate in n stances strictly health work from health departments. In chusetts, for instance, the control of factory sanitation has moved from the State board of health. Am I not right, Doc

Dr. A. J. MCLAUGHLIN. Yes; about two years ago.

The ACTING CHAIRMAN. In other States other subjects ha disassociated; and it has seemed to me that we should discuss what should come under State health departments, and if the that we agree upon are not in our State health departme effort should be to get them there, and in the meantime th on the part of our service should be frankly to recognize must cooperate with other agencies in a State as well as th health department; if all the health work is not done by them educational work and research work at least, we must turn agencies in addition to the State boards of health.

Dr. BRACKEN. I, for one, think that this program is exc made up. I think the subjects are all subjects that we ought cuss, and I do not know how we could formulate a progran than the one you have formulated for us.

INDUSTRIAL SANITATION.

The ACTING CHAIRMAN. If there is no objection on the par conference, we will take up the subject of industrial sanitati I will ask Mr. Bowman if he will not give his views of the that should be borne by the State department of health tow dustrial hygiene.

Mr. BOWMAN. In Ohio for several years past we have sadly from occupational diseases, resulting in the organizati

division of industrial hygiene. We feel that we have done considerable good work, but that more could have been done if the work had not been divided up so much between the other State departments. The Industrial Commission of Ohio has charge of a great deal of the work that should really belong to the State health department. The workshops and factory inspections and other work of the same kind are entirely without our control, and we are not even consulted in regard to the regulations that are adopted and enforced by that department.

Probably all of you have seen the report that was issued by Dr. E. R. Hayhurst, our director of the division, which is probably as good work as we have ever done in Ohio. I do not know whether any other State has done any better. If it would be of interest to any of you who have not received the report, I would be very glad to see that a copy of it is sent. That would give more definite information than anything that I could say in regard to it.

Dr. A. J. McLaughlin. Mr. Chairman, this subject comes pretty close to me. When I came into Massachusetts I found that a couple of years before industrial hygiene had been rudely snatched away from the State health department and placed under a new board called the State board of labor and industries. I know that the basic law under which we work in Massachusetts states that the State health department, formerly the State board of health, must take cognizance of the health and welfare of all the people of the Commonwealth, and it does not segregate them into age groups or into classes by occupation; and there is no way in which our department, under that broad authority, can dodge its plain obligation to consider industrial hygiene, even if certain specific laws bearing on industrial hygiene are placed in the hands of another State department for execution.

We feel that there should be one State board of health in the State, and in the past year several distinct attempts to build up State health departments in Massachusetts — miniature health departments — were frustrated. They were conceived innocently enough, without any malicious design; just carried away by their own enthuasism to do health work. One project provided for establishing a water and sewage laboratory. As you probably know, we have a pretty good water and sewage laboratory now in Massachusetts. Of course, that kind of duplication does not appeal to legislatures. Two other projects that were frustrated had to do with the educational department and the harbor and land commission. Still another one, which, however, is already established and which I am inclined to leave alone, is the vital statistics collection in the hands of the department of State.

I have a feeling that in a very short time industrial hyg
be where it belongs, back in the State department of health,
due deference to my very good friends the State board of l
industries, with whom I am cooperating most heartily rig
A commission appointed by the governor for the consolid
commissions has considered very carefully the making of s
combination of the industrial accident board, which han
workmen's compensation act; the State board of labor and in
which handles industrial hygiene; and the State board of l
conciliation.

The magnitude of the industrial hygiene problem frigh
In dealing with it we have been starting at the third or fou
rather than at the foundation, which is, after all, health in
As Dr. Warren suggested this morning, you have got to ge
the factory; you have got to take cognizance of the enviro
the individual working in the factory. That brings you
the question of health insurance.

Dr. BRACKEN. Mr. Chairman, I want to tell a rather unusu
that happened in our State. The labor commissioner frank
before the last legislature that industrial hygiene did not b
his department and that he wanted it to go to the State
health. We did not get it. Our legislature was lined up
liquor question last year. It was wets and drys, and not la

Dr. JEPSON. I might say, Mr. Chairman, that the law
Virginia, which was enacted only about a year ago, gives
health department considerable control over industrial
In the upper part of the State, about Wheeling, there are
many gas and iron works, potteries, etc. Potteries especi
supposed to be instrumental in causing tuberculosis. For
years a large number of cases of tuberculosis had been ch
a plant in Charleston, which is the largest in the world for th
facture of axes. Two years ago the president of our boa
myself, made a close investigation of that institution, an
that the proprietors were doing what seemed to be in thei
to control the disease. Of course, the principal danger o
culosis there was due to the grinding operations, and the pr
stated that he was gradually introducing the emery wheel in
the stone wheel; that he only had "8 or 10 carloads of ston
left," and as soon as those were exhausted the emery whee
be used entirely.

Only in the past week I sent an assistant to make a sani
spection of this institution, supplementing a survey which
made of the deaths from tuberculosis in that county and wh
shown that of 40 or 45 who had died 8 had worked at one

another in this ax factory. The assistant reported that the factory, as regards precautions against the disease, was in a very creditable condition; but he suggested a few improvements and suggested also that handbills (which are now in the course of preparation) be placed through the factory, with the consent of the proprietor, giving specific instructions as to how the operatives may, so far as possible, prevent the development of this disease.

The new organization of our health department being only about a year old, the appropriation small as yet, and our office force not adequate for the performance of all of its duties, we have not thus far given a very great deal of attention to industrial hygiene.

Dr. HAYNE. Mr. Chairman, the only industries of any great extent in South Carolina are the cotton-mill industry and the lumber mill. The State health department has entire charge of the health condition of these industries; but the commissioner of agriculture, commerce, and labor, very curiously, has control of the amount of humidity that shall be allowed in loom rooms, where they work over the looms. The only other health activity that is taken away from us is the enforcement of the pure food and drugs act. That is also under the agricultural department.

At present we are trying to get some laws passed to have sewerage, etc., put in in different mill villages, and I think we will succeed.

"SANITATION WEEK" OBSERVANCE.

The SURGEON GENERAL. We will take up the subject of "sanitation week" observance. We should be very glad to have the views of the conference as to the desirability of designating such special sanitation weeks. I will ask Dr. Lumsden to open the discussion.

Dr. LUMSDEN. Mr. Chairman, gentlemen of the conference, I am afraid that the chairman's selection of one to open this discussion is somewhat unfortunate, because I am overenthusiastic about sanitation weeks. I believe in 52 every year. Anything short of that is, I think, a dangerous makeshift, and one that I can not seriously advocate.

Every week a "sanitation week" is desirable, but in some instances it may not be practicable. From having one week in the year devoted to the advertisement of the subject of sanitation good results may eventuate, just as from a short religious revival the stimulus may be furnished for better regular services and lasting good. Just what is best to be done within 1 week out of the 52 in the year to start good propaganda for sanitation, I am not sure. I have not had any experience in this particular line of work. I have followed on the heels of a good many sanitation weeks or sanitation days and have found as a rule that most of the cleaning up that is done in

these short-service sanitation campaigns is devoted to th
which is the least harmful. It is devoted to cleaning u
twigs, waste paper, and other relatively harmless rubbish,
matter which we, as practical sanitarians, know is the m
gerous dirt in the community from a standpoint of diseas
tion is neglected. I have visited a good many communities
a very heroic program had been carried out, and found
insanitary privies, loaded up to the top board, and nume
breeding heaps of stable manure had not received any attenti
ever, but many wagonloads of yard rubbish and old car
rugs had been hauled away and burned up, with much ent
Such clean-ups can have little to do with the conservatio
health of the community and they foster erroneous ideas of
ciples of sanitation.

In a sanitation week in a community we, as health officer
strongly advocate a direction of the attention of the goo
having charge of these campaigns to the matter which is
dangerous. I think it would be better for them to
thoroughly 50 insanitary privies and 2 or 3 big heaps
manure, which could be done with very little money, than
$400 or $500 for destruction of the usual kind of rubbish
in clean-up weeks or clean-up days. I do not think the pe
touch this matter of sanitation without doing some good
believe that if the taxpayers of a town are going to spend
$500 for a clean-up, we should encourage them to spend th
in a way reasonably effective for the actual prevention of dis

The SURGEON GENERAL. Dr. Leathers, we would be glad
from you.

Dr. LEATHERS. Mr. Chairman, we have had some experie
this kind of work during the last two years. I think Dr.
is absolutely correct in that there should be 52 weeks in
during which the towns and cities of a State should be ke
But I think it is very important for all of us, as health o
realize the fact that there must be at times certain methods i
which you might call inspirational. In any kind of activit
after a time become rather of a routine nature, and theref
revival services, which may extend over varying periods of
just as necessary, I think, in sanitation as in religion.

Last year, in Mississippi, we were especially successful in
the women's clubs in what was termed a "cleanest town"
Towns and cities were grouped into those from 1,000 to 2,5
2,500 to 7,500, and so forth. The town getting first plac
group received a certain recognition.

I think that we made a slight error last year in not emp
the privy proposition enough. That is my hobby. If ther

thing which I have talked in Mississippi it has been the privy proposition in practically every community of the State. Last year, while we graded these towns on different things, such as dairies, general sanitation, privies, and different phases of sanitation as applicable to each town, we did not lay special emphasis on the privy problem. However, many of the people in the different towns realized that sanitation of their privies would have an important bearing on the results of the competition. It may have been a coincidence, in a way, but the town which won first place (Magnolia) had every privy sanitated; even the negro homes were clean, and many of the privies were brand new, with galvanized-iron receptacles. I went over the town myself when the contest was concluded, and it was a surprise to me to find the completeness with which the people of that town, especially the women, had worked for this definite result.

This year we have instituted a similar plan, and I might incidentally mention that this campaign extends over about three months and ends with a week of clean-up activity. The governor issues a proclamation, and there is a good deal of recognition given to the last week of the three-month period. This year we have placed on the grade card, in black, a statement to the effect that the privy problem was by far the most important factor in town and city sanitation, and that no town or city would be given first place, or perhaps any place, which did not have the privy problem worked out reasonably well. This year, therefore, I think we will get a number of towns in the State to devote special attention to this problem. For instance, in Jackson, the capital of the State and a city of about 26,000, they are instituting very rigid measures with reference to the privy system and for the purpose of making the people sanitate their homes properly, because they realize that they can not otherwise get first place. I believe that Dr. Lumsden will approve of this method.

Through such instruction I think we will get the people to realize that if it is a good thing for three months it is a good thing for 52 weeks in the year.

Dr. KERR. This subject was added to the program at my suggestion, but not with the idea that I would attempt to answer the question. It was added because in the bureau requests are received from time to time from individuals and unofficial organizations as to what is the best time to hold a sanitation day or a sanitation week observance, and what the program should be. I do not know whether the same questions have confronted State health officers or not, but it seemed to me as though it might be worth while for this conference and State officers generally to consider what was wanted and what should be recommended.

Dr. SWARTS. Mr. Chairman, the subject as presented by D
den, I think, covers the question entirely. The inhabitants
their ash heaps and cans and rubbish holes, but such cleani
more a matter of esthetics than it is of health. Health brir
down to the question of the transmission of disease from
garbage (which does not produce distinct disease unless
through flies carrying dysentery and diarrhea to children) a
transmission of typhoid from fecal matter. Therefore, it m
control of flies and manure heaps. I think we have taught th
too frequently already that decaying garbage and bad sm
duce disease. Nevertheless, it has been the practice in Rhod
for the last two years to take up the question of "clean-up a
up week." I have personally aided and abetted in carrying
campaign by automobile trips and by exposing my shirt sle
person to the moving-picture camera, registering action,
assistance of the neighboring contingent of women and child
The films were then exhibited in the moving-picture houses t
late and keep up the interest in the subject.

But I think the value of it comes here: That by increa
education and improving the environment of the people
them to the question of the removing at periodical intervals,
in 12 days, of the manure heaps and sufficiently often t
matter. The general education of the people strengthens th
of the health officer.

Mr. HANSEN. Mr. Chairman, in Illinois we have been tel
people in the small towns just what Dr. Lumsden has stated,
that clean-up weeks are effective in inducing people to clean
in a while and possibly also in stirring up a little enthusi
general health improvements, but that what is really necessa
cially in towns of over 5,000 population, is an efficient syste
collection and disposal of garbage and other wastes, prefer
der municipal auspices. I believe that the public-health au
have neglected their opportunities in the matter of city-wast
tion and disposal. State boards of health in particular ha
comparatively little thought to it. The only State board in t
try that has studied this problem is the Ohio one, and now
attempting to take up similar studies in Illinois. I should
suggest here that possibly the United States Public Health
may also profitably take up the subject of city waste collec
disposal, perhaps on a cooperative basis, with various cities
with the various State health departments.

Dr. LUMSDEN. I am particularly impressed, Mr. Chairma
the interpretation of "sanitation week" which we have h
Dr. Leathers. That is a different kind of sanitation week fr
I had in mind when I opened this discussion. I think the

sanitation week which they have tried out in Mississippi and which may be called the Mississippi scheme of sanitation-week observance is really effective. The results have shown it. It is not exactly a sanitation week but a sanitation period of several months followed by a week of inspection.

I do not think that we should compromise on this sanitation business. It is a life-saving business, and to show any disposition whatever to compromise, I think, weakens the faith that the public might have in us. If we say, "Oh, well, we ought to have those things fixed and keep them fixed all the time—52 weeks in the year—but we will have one clean-up week and get clean for once in the history of the town, if we never did it before and never do it again," I do not think that inspires the people with the right kind of confidence. I think we should always stick close to the line that "here is a serious business, and if you once give your attention to it, you are bound to see the sense in it, and once you see the sense in it, you can't think of slipping back on a proposition of this kind. These measures are easily carried out, and the results of letting them slip back are so disastrous that you can't afford to think of taking but one position on a proposition of this serious nature."

I notice in the program that the question is raised as to the desirability of designating such special week. I should think that in the South—that is, south of latitude of Washington—May 1 would be a good time to set apart. Probably April 1 would be better for sections south of the southern boundary of North Carolina. North of Washington June or July would be most suitable. A thorough clean-up of all fly-breeding material, including especially privy contents, at the beginning of summer weather will do some good. According to the observations of Faichnie and others, the most dangerous fly is not the one which has simply crawled over infected excreta, but is the fly which has bred in infected excreta. If we are going to have only one clean-up in the year, I think the time when that clean-up is done will have a good deal to do with the result.

(Dr. Kerr read the following telegram from Dr. A. C. McCormack, secretary of the State Board of Health of Kentucky:

CHICAGO, *May 13, 1916.*

DR. RUPERT BLUE,

Surgeon General, U. S. Public Health Service, Washington, D. C.:

Please accept sincere regret that State Board of Health of Kentucky can not be represented at the conference. Dr. Heizer and I are detained here on account of the suit brought by manufacturers of Wine of Cardui against the American Medical Association, and our board feels that this is of such importance that we are instructed to remain here.

I was particularly anxious to be present at this conference to express the gratitude felt by the people of Kentucky at the splendid demonstration the

Service has made of the possibility of the eradication of trachoma. desire to thank you for effective services in connection with the survey of the Ohio River and numerous sanitary surveys in the Stat

The increase in the effectiveness of the Service since you have command has been so marked as to command the confidence and r everyone interested in the health of the people, and this board des mally to congratulate you and to assure you of its loyal support. W to urge the conference to undertake through their Senators and Repres to secure increased personnel and necessary increases in scope of enable you to help the States to solve especially the problems of r small community sanitation.

By order of State Board of Health of Kentucky.

A. C. McCormack, *Secr*

MALARIA.

The Surgeon General. I will announce just one more topi adjournment. It is one of absorbing interest. As illustra importance of malaria in certain sections of the country state that information has been collected by our officials in which tends to show that in the Southern States east of Tex a population of more than 20,000,000, at least 4 per cen inhabitants suffer from an annual attack of malaria. T tremendous number when you consider that malaria is a pre disease.

I will ask Dr. Kerr to open the discussion.

Dr. Kerr (reading memorandum):

The second Pan-American Scientific Congress adopted the followi nineteenth resolution on January 7, 1916—

"That all American countries inaugurate a well-considered plan o eradication and control based upon the recognition of the principles disease is preventable to a much greater degree than has thus achieved, and that the education of the public in the elementary malaria is of the first order of importance to the country's concern."

In the furtherance of the objects of the above-mentioned reso proponent, Mr. Frederick L. Hoffman, took the initial step February looking to the formation of a national committee on the study and of malaria.

The following, who were invited by Mr. Hoffman to participa formation of such a committee, accepted the invitation:

Dr. C. C. Bass, medical department, Tulane University of Louis Orleans, La.

Dr. Rupert Blue, United States Public Health Service, Washingto

Dr. W. E. Britton, Connecticut Agricultural Experiment Station, N Conn.

Dr. H. R. Carter, United States Public Health Service, Marine Baltimore, Md.

Dr. Charles F. Craig, Medical Corps, United States Army, For worth, Kans.

Mr. F. S. Crum, assistant statistician, Prudential Insurance Co. o Newark, N. J.

Dr. William H. Deaderick, Hot Springs, Ark.

Mr. W. E. Deeks, United Fruit Co., 131 State Street, Boston, Mass.

Dr. Oscar Dowling, president State board of health, New Orleans, La.

Dr. W. C. Gorgas, United States Army, Washington, D. C.

Dr. Frederick R. Green, 535 North Dearborn Street, Chicago, Ill.

Dr. Seale Harris, editor, Southern Medical Journal, Empire Building, Birmingham, Ala.

Dr. Thomas J. Headlee, New Brunswick, N. J.

Dr. Graham E. Henson, Jacksonville, Fla.

Mr. Frederick L. Hoffman, statistician, Prudential Insurance Co. of America, Newark, N. J.

Dr. L. O. Howard, Department of Agriculture, Washington, D. C.

Mr. Arthur Hunter, 346 and 348 Broadway, New York City.

Dr. W. D. Hunter, United States Bureau of Entomology, Department of Agriculture. Washington, D. C.

Dr. J. W. Kerr, United States Public Health Service, Washington, D. C.

Dr. W. S. Leathers, Jackson, Miss.

Mr. J. A. A. Leprince, Marine Hospital, New Orleans, La.

Dr. Charles F. Mason, United States Army, Ancon, Canal Zone.

Dr. J. Y. Porter, Jacksonville, Fla.

Dr. W. S. Rankin, Raleigh, N. C.

Dr. M. J. Rosenau, Harvard Medical School, Boston, Mass.

Dr. E. R. Stitt, Navy Department, Washington, D. C.

Dr. John M. Swan, 457 Park Avenue, Rochester, N. Y.

Dr. W. S. Thayer, Baltimore, Md.

Dr. R. H. von Ezdorf, Marine Hospital, New Orleans, La.

Dr. Robert Wilson, Charleston, S. C.

A preliminary meeting was held in Washington on May 10, 1916, the following being present:

Dr. C. C. Bass, Dr. Rupert Blue, Dr. H. R. Carter, Dr. E. S. Crum, Dr. Seale Harris, Dr. T. J. Headlee, Dr. L. O. Howard, Dr. M. J. Rosenau, Dr. E. R. Stitt, Dr. John M. Swan, Dr. Robert Wilson, jr., Dr. W. S. Thayer, and Dr. J. W. Kerr.

After deliberation the following motions were adopted:

1. That a national committee on malaria be formed.

2. That the following plans of organization be adopted:

Objects of the committee.—The objects of the committee shall be (*a*) to stimulate interest in malaria problems; (*b*) to serve as a medium through which societies and individuals may become identified with the study and prevention of the disease; and (*c*) to coordinate the efforts of these agencies with constituted Federal, State, and local authorities.

Character of the organization.—The committee shall be a voluntary organization, its members shall serve without compensation, and there shall be no membership dues.

Membership.—Persons who have accepted membership shall be known as charter members.

The executive officers of the State boards of health of States in which malaria exists as a serious public-health problem and State officers charged with the enforcement of laws for the suppression of disease-bearing mosquitoes are invited to become members of the committee. Others interested in the objects of the committee may from time to time become members by vote of the committee.

Meetings.—There shall be a meeting of the committee once annua
call of the chairman at such time and place as he may deem most
Special meetings may be had, however, on the call of the chairman.

Officers.—There shall be an honorary chairman, an active chairm
secretary, to be selected by the committee.

Subcommittees.—Subcommittees shall be appointed by the chairma
out the active work of the central committee.

The following subcommittees are suggested: (1) Administration;
mology; (3) medical research; (4) education and publicity; (5) sa
gineering; (6) statistics.

Problems the solution of which is especially desirable for the c
malaria shall be presented to the appropriate subcommittee from tim
by the central committee.

Executive committee.—The honorary chairman, the active chairma
retary, and the chairmen of the subcommittees shall constitute the
committee of the organization (a majority of whom shall constitute a

State committees.—It is recommended that State committees be f
States in which malaria exists as a serious public-health problem.

SUBCOMMITTEES.

Administration.—The duties of this committee shall be to encourag
organization of State committees in affiliation with the national co
(2) the adoption of antimalarial measures by communities; (3) mal
veys and demonstrations of antimalarial work in suitable communi
cooperative effort in malarial work.

Entomology.—The duties of this committee shall be to encourage
quito surveys; (2) mosquito collections; (3) studies of entomologic
of the malaria problem.

Medical research.—The duties of this committee shall be to encou
studies of the life history of the malarial parasite; (2) its effects on
means for its destruction in man.

Education and publicity.—The duties of this committee shall be (
courage the teaching of the facts of malaria and its control in the sch
as far as may be, to standardize the subject matter and methods for
(2) to encourage the discussion of malaria in medical societies and
terested bodies; (3) to arrange for popular lectures on malaria to a
to school children; (4) to interest the public press and encourage it
on publicity campaigns on malaria in its columns.

Sanitary engineering.—The duties of this committee shall be (1) to
the employment by communities of skilled sanitary engineers, cont
drainage and other engineering measures for the control of malaria
confer with those engaged in drainage or impounding projects, so as t
the establishment of disease-breeding areas.

Statistics.—The duties of this committee shall be (1) to encoura
and localities to report and record cases of and deaths from malar
calities; (2) to standardize methods of tabulation to be used for this
(3) to encourage the collection and tabulation of data relating to the
of malaria.

In conformity with the above plan of organization the following
motions were adopted: (3) That Surg. Gen. Gorgas be made honora
man; (4) that Surg. Gen. Blue be made active chairman; (5) that
Harris be made secretary; (6) that meetings be held on call of the
after consultation with the secretary.

The interest of the service in this matter is to endeavor to assist in directing a movement which has already started, and to carry out as far as possible the objects of the resolution read at the beginning of this memorandum. It has always been the idea of the bureau, I think, that Federal, State, and local health authorities should be in a position to lead and to give a helping hand in any movement which was designed to improve health conditions. Here is a movement that is rather loose, but the object to be accomplished is extremely large, and for that reason the service took interest in this and presents this plan as it was adopted at the preliminary meeting on the 10th of May. It is highly desirable that State health officials should accept the invitation extended to become members of the committee and be in position actively to participate in the movement.

Dr. GARRISON. Mr. Chairman, I feel that any remark with reference to that outline is unnecessary. It seems to be rather comprehensive, and certainly timely. It is, as I see it, an attempt to coordinate and correlate various activities in various States in malarious sections, and I think we are more than willing to lend our personal assistance and offices to the furtherance of such an organization. Therefore, if it is in order, I would move that the plan as submitted be accepted and indorsed by this body, and that State health executives become members.

(The motion was seconded.)

The SURGEON GENERAL. If there is no objection, such will be considered the action of the conference.

(Thereupon the conference adjourned to Monday morning, May 15.)

Morning Session, May 15, 1916.

NEW BUSINESS—Continued.

CONSTITUTIONAL DISEASES.

(The conference was called to order at 10 o'clock a. m. by Dr. J. W. Kerr, acting chairman.)

The ACTING CHAIRMAN. We will take up next the subject of constitutional diseases, the extent to which they are public-health problems, and the official measures that may be inaugurated to reduce the increasing death and sickness rates from these diseases. I shall call on Dr. Hurty to open the discussion.

Dr. HURTY. The constitutional or degenerative diseases are certainly increasing. This is, I believe, an accepted fact. And now comes the question, What are we going to do about it? Our title asks, "the extent to which they are public-health problems?" I think they are as much public-health problems as are the acute

infectious diseases. Both are enemies of mankind, bringi
ing, disaster, and pecuniary loss. They lessen efficiency,
the sum total of happiness, threaten the race, and are mo
preventable. Surely, the degenerative diseases, appearing
in the age period of 40 to 60, if uncontrolled, may possibly
number of men of experience to such a serious degree as to l
ciety its ballast. "Old men for counsel, young men for war,"
and true adage, and the balance of youth and age, impulse
servatism, immature thought and wisdom, must not be distu
it is disturbed society will tip up.

As we all know, the increase in the duration of life note
time has a string tied to it. It may not be a blessing to
for more individuals to reach the age of 30 or 35 and fewer
50 or 60. If saving weak babies and bringing more in
to middle manhood and womanhood should cause nature to
her equilibrium by cutting down the old and experienced,
ciety will come upon evil days.

And in this connection we might hear Anatole France, wh

> After all of our efforts to prolong life it remains true that the ne
> species determine the duration of life and nothing else; and all we ca
> live on the best we can, knowing that things are as they are and the r
> be as they will be.

And further in this line of philosophy, hoping it will be
I quote again from France as follows:

> After all the reforms men are, as before, egotistical, greedy, cowar
> stupid, and furious in turn, and you always find about the same
> new-born babies, married people, fools, and hanged men, by which is
> the order of society. The order is stable, and nothing can possibly
> because it is based on misery and human imbecility and they are fo
> we shall never lack.

And permit another quotation, which is from Daven
which bears upon the subject before us. He says:

> Recent studies in heredity show it to be probable that every dise
> particularity of form, structure, and conduct of human beings are d
> in great part by a hereditary factor. The nervous history of ever
> thus, within limits, predetermined at the moment of conception.
> point of view the germ plasm carried by the parents becomes of p
> importance. The family physician, after becoming cognizant of a con
> marriage which must lead to nervously defective or weak offsprin
> take steps to prevent its consummation.

And continuing, he further says:

> If the rules of professional secrecy regarding matters of impo
> progeny work against social progress, then they are in so far immo
> physician should take an active part in race hygiene, or he may be
> in this capacity by the rise of a new profession.

And here in this organization we possibly see one nucleus, from which this new profession will rise or be born, or possibly is already born.

If only a part of the above-quoted philosophy is true, then it is apparent that any method of fighting disease other than genesis, as far as the race is concerned, will come largely if not entirely to naught.

Keeping pathogenic microbes out of our bodies, or their utter destruction—which is hardly possible—or the securing from birth of bodily tissues able to repel invasion; will prevent degenerative as well as zymotic diseases.

The latter way is premier, but is lightly recognized, and when recognized is unpopular, principally because it is fundamental and so very practical. A large maker of wagons told me "hickory is the only wood which makes strong wheels. It is becoming very scarce and the time is near when wooden wheels on wagons and buggies will hardly be seen. Hickory," said he, "stands stress, strain, and rot." We note these qualities are given to hickory in the beginning; they can not be acquired. Strong tissues, inherent with resistance and longevity, will bear great burdens and can not be crushed except by most extraordinary pressure. The first step therefore in disease prevention is the securing of strong resistant tissues to the coming generation—the week must not breed—and then, second, living sensibly. The rush for wealth and position is not sensible. Neither is overeating, or the eating of other than plain foods. And as for the absorbing of alcohol, caffein, nicotine, morphine, spices, and other drugs, such is foolishness itself.

Probably the prevention of the degenerative diseases takes precedence over the prevention of those known as acute infections, for they may bring more weakness and inefficiency into the world than the latter. Anyhow, as said in the beginning, I am sure the degenerative diseases are public health problems, and I believe their prevention in any degree will be attended by corresponding results concerning infections. Official measures would be almost entirely educational.

Let hygiene place plainly and forcibly before the people the fact that, as we can not gather figs of thistles, neither can we have strong progeny from weak parents.

A strong, virile race, resistant to disease, can not come out of weak, nonresistant germ plasm. "When conception takes place, the gate of gifts is closed." Then, given the real material, let hygiene teach sensible living.

Dr. RANKIN. Mr. Chairman, I think the subject Dr. Hurty has brought up here is one of the most important and timely subjects

which can be considered. I like to think of this problem
dition of what, in talking to the people, I have called, for
better term, the vital social unit. This unit is that group
out of whom one dies each year—a group of from 68 to 70

The point I wish to make can be represented graphicall
square stand for this vital social unit, with the figures "
In the lower left-hand corner place a cross representing
man—the lowest level of physical efficiency (0 per cent).
below the upper right-hand corner place a cross, represe
individual of the group who has reached the highest degree
cal efficiency (from 90 to 94 per cent). Draw a curve c
these two crosses. This will be the life line of the vital soc
and at various points along this line crosses can be placed
ing the other persons of the group. About two of these
bed all the time, some of them will be at a level of only 1
efficiency, others at 20 per cent, etc.

The interesting thing about that line and about what I
has brought out is this: Where is the most important part o
so far as increasing the physical efficiency of the individu
cerned? If we start working with the lower end of the
can spend an enormous amount of money in raising those
10, or 30 per cent in their physical efficiency (in their
state and to grasp an idea and apply it to life, or to enjoy
yet we have accomplished very little. It is worth more to
try to raise the physical efficiency of Dr. Hurty or Dr.
president of the University of North Carolina, 1 per cent
to save the lives of a hundred persons belonging to certa
in North Carolina and Indiana.

The upper end of the line is the one to work with, as I
has indicated. The further we let a fellow slide from the r
corner down the incline the more money we will have
and the harder we will have to push to get him back.

We talk about saving the lives of babies and children. I
the life of a baby you have saved, economically consider
$500; but if you save the life of a man 30 years old you h
$4,000. It is worth eight times as much to this country t
man's life.

Dr. Hurty brought out another thing which we have got
our ideas about in preventive medicine, and I wish simply
what he said in another way for emphasis. Most of us t
typhoid fever and pneumonia and tuberculosis are very
diseases. I want to tell you that pyorrhea alveolaris is
more important than typhoid fever, with all due respe
Lumsden, who is specially interested in the latter. H
man with pyorrhea alveolaris. His efficiency is pulled

about 2 or 3 per cent per day from the constant absorption of poisons, from the slight indigestion which he gets from swallowing these poisons and a lack of mastication, perhaps from rheumatic attacks which he now and then has. Typhoid fever may cost a man about $400 from the time he gets into bed until he gets out and pays his doctor and his druggist; but the man with pyorrhea alveolaris has lost three, four, or five thousand dollars as a result of prolonged impaired efficiency. Similarly, the man who loses $50 out of his pocket at one time thinks that $50 is more important than an expenditure of from 5 to 15 cents a day, which would be something like $1,000 in 20 years.

You do not have to increase a man's ability to grasp an idea more than just a little bit, 2 or 3 per cent, to increase the man's income in all kinds of ways. You can see that. Here is a fellow getting $1,000 a year, to take a material illustration again. You only increase the man's salary $200. That is not a big increase, but on the income of $1,000 a year that man was not saving but $100 over and above his expenses, and now it is possible for him to save three times that much, and it is the reserve that counts. The point that Dr. Hurty brings out here is a most important one. This idea of starting with the well, with the physically valuable, and the idea of cutting out these diseases which we have not recognized the importance of, these minor things, the 20 per cent of constipation in this country, the pyorrhea alveolaris, the excessive eating and such things, is worth consideration. We must put a new health idea into the minds of the people, and it is coming right along this line.

The ACTING CHAIRMAN. As previously stated, this program was arranged with the idea of taking stock, in a measure, of those problems that we, as State and Federal health officials, should take into account. This particular topic might seem to have been rather far-fetched; but I feel that it is not, and that we as health officers must consider it.

Several years ago, when the antituberculosis movement was begun, it was, in a measure at least, an unofficial effort, and continued so except here and there, and the States and health officials generally did not take as active a part in it as they should have done and as they perhaps would have done had they inaugurated it. It is for that reason that these subjects are presented this morning.

Dr. LUMSDEN. Mr. Chairman, I wish to suggest in this connection the possibility that the ills we bear in our early life as a result of grossly insanitary conditions in our environment may have some effect on our future health and efficiency after we have reached the age of 40.

The prevention of hookworm disease is, I believe, one of the crudest problems which we have in our whole public health field. Yet a

human being who, from the age of 2 to the age of 20 years burdened with a severe hookworm infection has not as good of being, after he has reached the age of 40, a strong, ab unit in our conservation system as he would have if he had so burdened and had his vitality not been sapped through years.

Dr. JEPSON. Mr. Chairman, it occurs to me that the gentl have spoken have not offered a solution of the problem or an means whereby we can prevent this degeneration in middl after.

Some one has said that intimate acquaintance with Venus and Vulcan has much to do with the degeneration observed years of age. I may be permitted, possibly, to cite my ow one who has not made an intimate acquaintance with any characters, and in addition as one having had an heredity favorable; and I find myself to-day, if none of you will West Virginia, 74 years of age and in reasonably good condition.

Therefore, I would suggest that you begin instructing t people as to the importance of a good heredity. Most of our work, after all, is teaching. If we can make a good start b a couple vigorous in mind and body, and then if they will acquaintance of these celebrated characters of history to whi referred, I think they may find themselves in the northea of Dr. Rankin's chart, where I claim to be to-day myself.

Dr. RUCKER. Mr. Chairman, quite a number of the office Public Health Service have at one time and another disc problem of where this hygienic sanitary movement is leadin I have heard very grave doubts expressed as to the ultimate it all, because the claim was made that after all is said an aims at the perpetuation of the unfit; it aims to take care of who has not brains enough to take care of himself.

It seems to me that this paper this morning answers the q that instead of perpetuating the unfit we should endeavor to more fit. When we have done that, then we have balanced are doing in the perpetuation of the unfit.

Of course, it seems as though education were the great entirely agree with the thought that education is essential; believe—and I can speak on this point freely because I h as guilty as anyone—that education does not mean merely th and the written word. I believe we have gotten to a point in where we can educate by demonstration; and after all, tha the people of this country want. They want to be show want to have something very definite and tangible that they c ut and put their finger on.

I think what we have got to do is this: We have got to talk less and do more. We have got to deliver more goods to the people of this country if we want to continue to do the health work for the people of this country. While I agree with the idea that Dr. Rankin sets forth about the man with typhoid fever and his loss of $400, the study of mankind shows that the adult has to have a good, severe lesson of that kind in order to learn it. All or practically all of the Federal health legislation of this country has been brought about by reason of an epidemic or the fear of an epidemic. There the people had a demonstration right before their eyes; and I think we would be very wise if we would follow that system in the psychology of our work.

You take, for example, the model town that Dr. Lumsden has created. There it is true that he gives them a certain amount of the spoken word, but with it he hands them a practical demonstration. Faith without works is dead, and it is the works that count in this sanitary problem. If we can give the adult a definite demonstration, he will do something.

Now, as regards the teaching by other means, I think there is just one point to think about, and that is this: That you can not make an adult, by ordinary teaching, change his hygienic habits. You must rely for your spoken word upon the child whose mind is plastic and expect to get your results in 30 years.

Dr. HURTY. One point with regard to what Dr. Rankin said. It is true that it is more worth while to save a man who is 30 or 40 or 50 years old, or increase his efficiency somewhat, than it is to save a baby. As a financial proposition it is sound. And it is also true that it does not matter how well born a baby is and how strong it is, if it is not put into the right environment it will not live, it will not develop, and it will not have the proper equipment when it gets older. You must go back behind youth. Rotten parents can not breed strong children.

Now, in regard to education, you can not educate an idiot, a moron, a mental defective. You can only educate those who have been born with a sound brain, with a proper moral disposition to receive education, and with a power in their inherent make-up to apply it. If they have not these qualities they must perish. You can not preserve them.

Oliver Wendell Holmes said:

> If you want to live long, you must acquire a deadly disease and take care of yourself.

But what is the use of saving a person with a deadly disease? Such can not be useful to society. They only prolong their days of sorrow and misery, and will probably increase the burden upon society.

Death is not such a horrible and awful thing. It is one greatest blessings we have. The destruction of a person w career is ended is high human economy. We should be we with good tissues—liver tissue, kidney tissue, heart tissu tissue, nervous tissue, all tissues of such high quality that t stand the stress and strain and weight and burden of life.

With strength given, of course, environment, education, nutrition are necessary. One of the greatest banes of life, that is bringing a great deal of sickness, is the unnecessary r we take. I find, upon consulting the United States statist the people of this country spend $500,000,000 a year for m That is about four times as much per capita as any othe spends. All know medicines are injurious. I believe that are any benefits attendant upon this terrible war in Europe them is that it has cut off the German supply of synthetic r It has stopped the importation of aspirin, acetanilid, and damnable synthetics we have been getting to our detriment degeneration of our race.

My remedy is to have mankind well born. That is perfe sible, though, of course, it can not be done immediately. It i a big job. Then the well born, those descended from good st turn out well.

A man in Indiana had a reputation as a raiser of hogs, hogs did not have cholera. I called to see why they did cholera, for the farmers all around him had it among the He said:

'Well, first, these people don't pay attention to their stock. They old stock; and then, second, they don't take care of it when they get let the animals wallow in the stream. Then if the hogs up the str cholera, no matter how good and well bred the stock is below, they ge

I buy a good many hogs. I buy, say, a group of 10. I put them i tine and see whether or not they develop any sickness. If they do, fool with them; I do not try any medicines; I kill and tank them. Su of the 10 does get sick—I have nine left. Then I move the nine t quarantine pen and let them "weather" to be sure that there is no to follow; and generally the nine will come through. Then I turn the the rest of the herd and then surround them with good sanitary con you see.

He kept them on hillsides mostly. He did not let them w streams or pools, but hosed them off on his brick table, as he "That is a good thing," he said, "but I want to show you think is the great thing in raising hogs and getting rid of We went toward a pen where there was a rather large ho He called "Hoo! Hoo!" and out came a great big boar large as a rhinoceros, and he said: "His babies don't get sic is all there is to it."

COMMITTEE ON RESOLUTIONS.

The ACTING CHAIRMAN. I understand that Dr. Lindsay Williams, the delegate from New York, is not present. I will therefore ask Dr. Rankin to take his place on the resolutions committee.

SCHOOL HYGIENE.

We will now take up the subject of school hygiene, and the scope of this work so far as health officers are concerned.

Dr. BRACKEN. This is logically a public-health problem, but apparently educational authorities want to assume these responsibilities to a great extent.

Up to the present time State health authorities quite generally have not been in a position to assume the responsibilities relating to school hygiene because of (*a*) lack of authority or (*b*) lack of funds.

State educational authorities have done little or nothing of importance up to the present time as bearing upon school hygiene, even though they may in some instances at least have had both (*a*) authority and (*b*) funds. This is not strange, for they are dealing with problems of which they have little practical knowledge.

Educators have argued that boards of education are (*a*) more stable, because less influenced by politics and other outside matters, and (*b*) better prepared both as to stability and financial conditions to handle these problems than are boards of health. This may be true in some of the larger cities, but so far as relates to stability and freedom from political influence it is not true, for some States at least. So far as relates to funds it may be true in most instances for both State and municipality.

School hygiene has been in the hands of educators up to the present time. In many States and in most of the large cities there has been little, if any, progress made during the past 15 years in the development of this most important work. Why? Because educators do not know how to handle the problem, and apparently they are not willing to turn it over to health workers who should know how to handle it.

There is no satisfactory system as far as relates to school hygiene to-day in the United States. There are isolated cases, both State and municipal, where good work is being done, but this is due to individual efficiency or accidental conditions rather than to any well-organized system.

If one reviews the present condition of school hygiene it would appear that educators had surely demonstrated their inefficiency for such work. This is not strange, for they have had no preparatory training along these lines. Wherever good work has been

done it has been under the supervision of medical men who h preliminary training or have trained themselves after recei pointments. This latter method of training is lacking economy and efficiency.

It would appear that the time was ripe for putting school on a proper basis. To do this there should be under eve health organization a division or bureau devoted exclus school hygiene. This division should have control of all problems relating to (1) the construction and equipment o buildings, (2) the operation of school buildings, and (3) the supervision of school children so far as pertains to (*a*) m physical defects, (*b*) preventable diseases, (*c*) open-air sch (*d*) open-air schoolrooms.

Such a division should have control of all rural schools schools in the smaller municipalities.

In the larger cities there should be a division in the he partment devoted exclusively to school hygiene, unless th department is weak in organization and under the domin politics. If these latter unfortunate conditions should ex city, then the department of education may undertake to work, but it should be understood that this is not one of i tions and that the performance of these duties by the board cation should be considered a criticism on the efficiency or ability of the municipal board of health.

If a health department has no funds and a school boar might be wise for the latter board to pay the salaries neces physicians and nurses, but this should be with the distinc standing that it is done not as a question of duty but of exp If under such an arrangement the employees of the board satisfactory to the board of education, the latter can prote by the withdrawal of funds, if necessary. Such a scheme lined above would call for a degree of unselfishness whic willing to admit is hardly to be expected.

All State health authorities that have given close attentio control of the spread of disease know how helpless school au are in rural and semirural districts when it comes to the han such problems. On the other hand, they are fully inform how easy it is for a well-organized health department to co spread of disease in schools.

Although much has been recently written relative to progr in sanitation as relates to the construction and operation o buildings, it is easy to find conditions in many of the most constructed school buildings which are subject to most seve cism as relates to orientation, lighting, heating, and ventilat

The teaching of hygiene in schools is a function of the department of education, but this department should avail itself to some extent of opportunities for instruction to be given by public health workers.

Dr. A. J. McLaughlin. Mr. Chairman, I quite agree with Dr. Bracken that school hygiene, including medical inspection of school children and the teaching of hygiene, should be a function controlled by the State authorities, and I also believe that it should be controlled by the State health authorities.

The effort by the Massachusetts Department of Education to form a division of child welfare which would have charge of child hygiene and the inspection of schools was not maliciously done. It was done through an excess of enthusiasm on the part of the educational authorities, in view of the fact that nothing was being done by the State board of health to coordinate the medical inspection of schools; but I think we convinced the legislature that there should be one department of health in the State, and that every dollar appropriated by the State for the prevention of disease should be spent either by that department or under its direction and advice. They withdrew their effort, and we are now going to attempt to supervise the medical inspection of school children in the State in our subdivision of child welfare.

The school as an agent in life saving and disease prevention is not appreciated. I believe that it is the biggest instrument in public-health work to-day for the prevention of disease; and I know of nothing else that in the future is likely to come in as a competitor in results, except, perhaps, health insurance.

It may be many years before we utilize either of those instruments to their full possibilities; but take the child, for instance, who is our most direct point of attack on a problem like tuberculosis, and it is pitiful to see the way in which this instrument has been used in Massachusetts. We have a law there which makes it compulsory to have medical inspection of school children—a so-called school hygiene law—and yet in 100 different places it is done in 100 different ways, according to the individual dictates of the man who happens to have charge of it. One man has a mania for adenoids; another can see nothing but teeth; another man thinks his only function is to find the contagious diseases of childhood, and the educational authorities often encourage him in that, and that is where his work begins and ends. Some health officers will have nothing to do with school children except in a case of scarlet fever. They do not recognize that child hygiene is broader than that, so far as the health officer is concerned. They say: "Our work goes to the line of measles and scarlet fever. Then the educational authorities take it over."

I believe a real system of child hygiene should carry th through, so that not only the physically weak and mental de are found, but, more important than all, the well child is ke and the standard of those who are below par is raised.

The question of authority comes up. I do not believe y any authority where you have a law requiring the medical in of schools. I believe that we can get results in Massachusetts any specific authority being given us over the local commun think we can correlate their efforts and bring some order chaos without any further specific authority.

As to who shall do it in the cities and towns, I think Dr. has well said that in many places the board of health has appropriation or equipment to go ahead and do it; and, a gentlemen, we must remember one thing, that our schools are primarily for education, and that while we should control th of how the money is spent in preventing disease, we should turb the curriculum of the schools. We should consider the ties who are controlling the schools, and allow them to r schools, but go to them and say: "Gentlemen, we are willing in the hours you state and to make our visits at the times y but as to how we shall attempt to prevent disease in this w is the policy of the health department and not the policy of th of education."

The ACTING CHAIRMAN. It has seemed to me that we sho determine the limitations of our field in this respect and r the peculiar duties of educational authorities; that is, that th determine the amount of time that shall be devoted to hygiene and how it shall be taught to children. That is th ness; but it does seem to me also as though the health au should advise with them as to the facts to be taught and th tion of facts, and that the health authorities should be depe to protect the health of the child during its period of con occupation.

The next subject on the program is that of rural sanitatio shall ask Dr. Rankin to open the discussion.

RURAL SANITATION.

Dr. RANKIN. Mr. Chairman and gentlemen, the subject sanitation is important for two reasons. One is its size 53 per cent of the people of the United States live und government. Over 99 per cent of the area of the Unite comes within the rural or county government. In certain of the country—for example, in the South—the local gov the government closest to the people and through which th

to operate and learn self-control in the case of about 80 per cent of the people, is the county government. In my own State 90 per cent of the people live under it. Rural sanitation is important, then, on account of the size of the problem.

The second reason why it is important is on account of the state of development of rural sanitation. There are four governments in the country—the Federal, the State, the town or city government, and the rural or county government. You go to the Federal Government and the State governments and the urban governments, and you find fairly definite plans for dealing with sanitary problems. You go to the fourth government, the rural or county government, and everything is chaos. There are no plans; but on the other hand, there is an enormously and rapidly developing interest on the part of the people themselves in rural health government. They are demanding that their counties shall do something, and the counties have to respond. They are going to do something, and they are adopting all kinds of plans of work.

The point I want to make, gentlemen, is this: That after these counties in five or six years have adopted all kinds of plans for county health work, you are not going to get them to change; or, if you get them to change then, you must tear down a system and build it up again from the ground. So that, if we are going to direct and shape the development of the rural government in health work, this important and near government to the people, we have got to do it right now in the next two or three years.

Those are two points I want to make with regard to the importance of rural sanitation—the size of the problem and the present state of its development. If you are going to train a child you must do so while it is young. If you let that child go until it is 13 or 14 years old, you will not do much for it.

Now, how are you going to direct or develop the rural or county sanitary administration? There are several ways proposed. In the first place, it is proposed by a number of States that the State general assemblies or State legislatures shall pass an act requiring every one of those counties to have a whole-time county health officer; or, if not all the counties, that certain combinations of counties shall have a whole-time county health officer.

What are going to be his functions? Why, the State board of health will determine that. In other words, we will take a division of the local government and centralize it. We will let the local government put up the money, and the central government will direct the work. I think that where that can be done it is probably the very best thing that can be done. I just want to say, however, to those who are contemplating doing that thing—passing a whole-time county health officer law—that if they will take a piece of paper and

try to put down what that whole-time county health officer to do and how he is going to do it, they will find that j tenfold more difficult than the job of getting a whole-time m

According to natural law, function always precedes struct have not been following that general scheme in advoca whole-time health-officer proposition. I have not. I have the counties and said: "Let us have a whole-time man. Th of the most important problems we have. Let us put in a n his entire time, to take care of it." They put that man th for the last three to six years he has been trying to find ou take care of the job.

What are going to be the methods of the whole-time coun officer? If you will answer that question and send me the you certainly will confer a great benefit and favor on my S is the most difficult problem I have ever confronted—trying the functions of the whole-time county health officer and the by which those functions shall be carried out. That is a th ought to be considered by all the States that are contemplati ing a wholesale law for whole-time county health officers.

The foregoing is one way to get a whole-time health of one way to direct his work. Make it a State matter inst local matter. The other way, which my State and other Sta followed and will have to follow, is to make the whole thing of self-government. Go to the county instead of the ger sembly and prove to the people of that county in various w men have of proving a public proposition—through new speeches, bulletins, letters, etc.—that they need a whole-ti and that they ought to invest $3,000 or $4,000 in getting time man. That method has the advantage over the State in one particular. You must educate public sentiment; y line up the majority of the people of the county behind i you can get it; whereas in the State general assembly a who counties may not want it, and they have to take it anywa might consider that in passing.

Now as to the direction of the whole-time man. There dealing with the matter on a principle of government more mental than sanitary administration. We are dealing with t fundamental principle of government in this country—the p of democracy itself. You and I may or may not believe in cratic form of government, but that is not a matter for us to here. We have a democratic government, we are going to democratic government, and we have got to shape our health in conformity with the principle of democracy, which is mentally local self-government. And I believe in it, too. I

that it is the form of government that Christ himself taught. The government should be brought just as close to the individual as possible. In being taught self-government, the individual should learn self-control, the highest object of attainment.

That means that in the development of rural sanitation we must recognize the rights of local government, ignorant as it may be, to have the final say in what the health officer is going to do. "But," you say, "it will cost a lot of lives. They are inefficient; they are not so well trained as the State board of health, as a body of experts." That is so. But, my friends, if it costs a lot of lives for them to learn the art of self-government in health matters, then it will cost a lot of knowledge for them not to learn it; and you have got to choose between human life and experience and knowledge. And I do not know but what knowledge, experience, is the more important. Human life, as Dr. Hurty has said, is not the most valuable thing, after all.

Now, I believe there is a way of planning and of making efficient this rural or local government without trampling upon the principle of local self-government. I believe there are two ways in which that can be done. One way (and that is where the relation of the States to the Federal service comes in) is for the Federal Government and the States to work out together a model plan of county or rural health work. As it is, the United States Public Health Service is to send a man to a North Carolina county, after he has gone all over this country to study rural health work, to devise and put into execution a model plan of county health work. When that is done the Public Health Service can say: "This is what we stand for; this is our standard and model plan of county health work; and wherever we find a county health officer carrying out this plan, we will indorse his work." Then suppose the State government comes in and says, "That is our plan, too," so that down there in my State, or in your State, there will be a model or standard plan of county health work indorsed by the Federal Government and by the State government. Then we could say to any of the whole-time health officers: "If you carry out this plan here, and you get into trouble with politicians of that county or anybody else, we stand squarely behind you."

The plan will embrace the idea of reports, comparisons, and checks, so that when we publish every once in a while, in the publications of this office, that this county ranks 90, this one 80, and this one 100, we will be placing a premium on the man who is doing good work and make it worth his while.

There is nothing in the creation of a model plan of county health work—a plan indorsed by the Federal Government and the State government and adopted by the local government—that infringes upon the principle of local self-government. It is voluntary on the

part of the county to adopt it. That is one method for de
a system of rural health government or rural sanitat
right there is where this Government, the Federal Health
and the States may cooperate with mutual advantage.
lieve it is one of the functions of the Federal Governm
Public Health Service—to do administrative research, worl
character. It is just as much its business to work out these
of administrative research as it is to do scientific research.
ask the Service to come to North Carolina to operate a mo
of county health work, but to help devise it. I ought to b
come here and say: "What kind of research work have you
this administrative principle? What results have you o
What conclusions have you arrived at?"

There is another method of dealing with this principle.
sanitation without ignoring the principle of self-governm
that is what we have been working on in my State under
have called the unit system of county health work. We
whole county health problem and divide it into several ind
smaller problems. We say: "Here is your typhoid proble
is independent of your tuberculosis problem, of your op
neonatorum problem, of your school hygiene problem; all
smaller problems are independent of each other. One of
ways in which we can handle the typhoid problem is to g
county as complete a vaccination as possible." So we worl
of the details of a plan of vaccination. We lay that before th
commissioners and say: "We will do that for you for $400.
put in five weeks' work and vaccinate your people for 10 cent
or we will do the whole work for $400." There is no violatio
principle of self-government in that case.

As an illustration, we carried out that plan in 12 North
counties last year and vaccinated 52,000 people, an average
per county, at an expense of about $500 per county. We v
them this year for $400 per county, employing our own offi
other words, we simply increase the appropriation that the
assembly has made to us by going to the county and getting
put up some more for special county work.

Take the work which Dr. Hurty has just mentioned.
attempting to make a unit of county health work out of dege
diseases, and we are working now on a plan for dealing wi
Briefly it is this: We are going to take a young man, a gra
an A-1 college who has had two or three years in one of
hospitals in the country; who is, as compared with the physi
the county, a fine diagnostician and modern in his ideas a
practice of medicine. We are going before the medical so
——— County. We will say: "Here, gentlemen, we want

indorse this piece of work, and we want you to help us get an appropriation of $500 from your county commissioners for it. This man here is going to spend the first week in this county, lecturing in from 6 to 10 places in the more important towns, telling the people about the importance of periodic medical examinations after 30." Instead of taking the common defects of the children, or a group of diseases such as adenoids, eye, ear, and throat troubles, we are going to create a list of diseases, 6 to 10, that are common to the ages between 30 and 60, such as arteriosclerosis, tuberculosis, and Bright's disease. That is why we say examinations of those over 30 instead of those over 40.

During the lecture tour of this man there will be a good deal of newspaper stuff running, a lot of circular letters, and a lot of placards posted over the county. After getting the population thoroughly interested in the idea of a periodic medical examination, the man will for two months have offices at the county seat, where he can be seen by anybody over the age of 30 for a periodic examination. It will not be a complete physical examination, any more than the school child is given a complete physical examination, but it will be sufficient to detect the common diseases of this period of life, and each person examined will be told what he has and how he can guard against it. Our man will not treat any diseases. He will refer them all to their family physicians. He is going to line up the family doctors with him, because it is to their interest to have these examinations made.

The Federal Children's Bureau is in North Carolina at present trying to work out a unit on infant hygiene that can be applied according to the method used in rural sanitation.

To conclude, these are the two methods which we are trying to follow: The creation of a standard plan for county health officers to adopt, and the unit system of going to the county and making a definite contract with them for doing the work and letting them pay for it.

Dr. TRASK. Mr. Chairman, it seems to me that the point raised as to the logical application of democratic government is an exceedingly important one in connection with municipal health work, State health work, and Federal health work, and is especially applicable, as brought out, to the question of rural sanitation. I have had difficulty in deciding in my own mind what is a logical application of democratic government. Does it consist in letting each State make its own laws and determine what it shall do in a public health way (limiting our argument for the present merely to public health matters), or does it go one step further and say that in each State each county shall have autonomy in public health matters? Or does

it go to each incorporated town and township in each county? And if it goes there, why not to each household; and if to each household, why not to each individual?

In a thing like public health administration, assuming an intelligent, honest, public service, that form of government will be most effective which covers the largest area and includes the greatest number of people; for the control of disease and the preservation of health can seldom be limited to political subdivisions. In this country each State is autonomous as relates to its own public health matters. But I am not sure that efficiency and the better interests of the people do not suffer when there is a lack of definite correlation of the public health agencies within a State under a strong State health department. It is difficult, to be sure; it takes men and it takes money; it takes thought and attention for a State health department or those at the head of the State health department, to grasp a great, big thing like a system of public health administration for a whole State. It would be far easier to say that each county should take care of itself, and when it came to the county to say that each township and town should take care of itself, and when it came to the city, sometimes the path of least resistance would be to say, "Tell the householders what they should do through the newspapers, by lectures, and by exhibits. Educate them in that way. That is all that can be done."

I think that this is an important question, and that it is exceedingly pertinent to this conference. It may not be entirely pertinent to the subject under consideration, but it was brought up by the previous speaker.

In regard to the question of degenerative diseases, while the physical examination of persons of 30 years of age and older is a good thing as a side issue and will be beneficial, it seems to me that a public health examination of each child means far more. The grown-up is lost. He is what he is and never will be anything else. But if you can protect and teach the child, you will in future have an adult who will be a distinct asset to the community. When these children grow up, we will have a generation that will relieve us of much of the worry of public health administration, because we will have an intelligent generation of people who know what public health is and how it should be protected, and all we will have to do is to carry out their instructions and they will see that we do what we should for public health. They will see that there is proper health protection.

Dr. TUTTLE. Mr. Chairman, it seems to me that real rural sanitation (and in rural sanitation I include the small towns, anything less than 2,500), is to a very large extent the foundation of our public health work to-day. In Washington last year we studied

our typhoid returns very carefully, and found that 94 per cent of our cases of typhoid fever, though a good many of them were reported from cities, were in fact of country origin.

How are we going to get at this country work? As to Dr. Rankin's idea that the Public Health Service shall lay out some rule for whole-time health officers, I am wondering how a system which works well for North Carolina, South Carolina, Virginia, or Georgia would work out in Washington or Montana. We have a system something like that, and it does not work very well. But it seemed to me that Dr. Rankin struck the keynote of our failure in rural sanitation. We are going to employ an A–1 man, and send him to the principal cities in our counties, and he is going to talk in the principal cities.

What does the farmer know about a health officer? I have gone out and sat on their front porches and talked to them, and what do they say? They say: "What is the health officer good for? He comes out here and tells me I have got to clean up my place or I can't sell stuff in the city." He does not know anything about a health officer who comes out there and tells him, "Mr. Farmer, your boy hasn't been doing very well for the last year, has he?" "No, he hasn't; but how can I help it?" Tell him how he can help it in a practical way. If we can do rural sanitation work, we will stop having typhoid fever in the city, and that is where we have got to approach the individual man and show him it is something of interest for him and not for the health authorities.

Dr. BRACKEN. Mr. Chairman, I have been very much interested in the discussion. Dr. Rankin has pointed out the virtues of democratic government, and Dr. Trask has given us the other extreme; but I think these two gentlemen really agree. I think Dr. Rankin has made some excellent suggestions. If he can persuade the county commissioners to assume this responsibility I congratulate him. I am coming down to North Carolina some time to see how he does it, then maybe I can go back to Minnesota and do it. I hope so.

Dr. KELLEY. Mr. Chairman, I would like to ask Dr. Rankin two questions. First, I have been interested in his plan of carrying out this unit administration ever since he first broached it about two years ago. It has all been most instructive and certainly must have produced a very considerable degree of good. I was wondering if he has any data in North Carolina, or if any of the other States or the Service have, on a similar type of campaign which has been very heavily financed both by the States and by private organization—the hookworm campaign. As near as I can determine, it has been carried on for quite a number of years along these lines of a maximum of effort to arouse the attention of the people to the existence of the problem, plus the offer of immediate assistance to

eradicate the condition, plus fundamental, simple sanita
neering principles to remove the sources of future infection
three fundamental principles, I take it from what we ha
of the hookworm campaign, have been carried out very con
we will say, in North Carolina, for six or seven years. Am

Dr. RANKIN. Yes; six years.

Dr. KELLEY. Now, would you judge that you had got 2
or 60 per cent efficiency result in North Carolina from th
point of removing the hookworm menace; and if not, why no

The other question is similar. Dr. Rankin's scheme aim
ting an expert interne to go into a given county, arouse great
interest in the wear-and-tear diseases, urge the people to com
consult with him, and then refer them back to the family p
Would there be a comeback that would adversely affect the
public health a great deal more than the agitation of t
would promote public health? It seems to me there might b
terpretation: Some rude and unfeeling element in the co
would say, "Here we have a spectacle of the agent of the
trust hiring a medical booster, paying for it out of the publ
to drive our people back to the doctors to get more money a
business for them." I wonder how they get around that po

Dr. RANKIN. I can not give Dr. Kelley any definite answ
first question. I think the Rockefeller work has done a g
of good, and a great many people are now interested in s
who would not have been had it not been for the campaign;
saying just what the effect has been. I myself feel that there
been enough check-up work of that kind done by the com
taking counties and comparing conditions before and after
not give anything definite. I would rather let the co
answer that question.

The second question which Dr. Kelley raised, the effect of
cases found by a public official to the medical profession, is
that I have considered. It is a thing to be thought of by
undertaking work of that kind. There are advantages an
vantages. For example, in a number of States the medical p
are rather critical toward the public-health officials for givi
so little attention and disregarding them altogether in heal
Now, we can certainly make it plain that this piece of wo
public benefit, and I do not think we need hesitate to say t
also of a business advantage to the profession to have it
well as in accord with the humanitarian motives of the pr
It remains to see just how the public will take that. I e
some counties that point would be made and in other co
would not be made.

Dr. LUMSDEN. Mr. Chairman, it seems to me that in the discussion of this very important subject of rural sanitation we have had this morning a difference of expression of opinion rather than a difference of opinion. We all agree that this is a big problem. There is no doubt that it is a problem which reaches the individual in the home. It reaches the father, the mother, and the children directly and individually and collectively. It reaches the township, it reaches the county, it reaches the State, and it radiates throughout the Nation. It is one of our big local problems; it is also one of our big interstate, or national, problems. Therefore, it seems to me, in attacking this problem, all of our governmental forces may combine to advantage. The big question before us is how we can cooperate to the best advantage.

In every field of work in which forces from the several political divisions of our Government have engaged, serious questions have arisen about where the rights of one governmental body should stop and where the rights of the other governmental bodies should begin. In the attempt to solve the problem of "State rights" we once had a terrible civil war and now, over 50 years since that war ended, that problem is still unsolved. Some of the principles involved in the War between the States have been under serious discussion in our Halls of Congress within the last few weeks in the course of the debate on the good-roads bill. The exact separation of functions of our National, State, and local governments is a tremendous question upon which the master minds of this country will probably never entirely agree. In the great field of health work upon which we are engaged it seems that we are having less trouble with our "twilight zones" than are those engaged in other fields of work. We are cooperating, and we are cooperating better and better every year; we are cooperating better because the people, the individual units in our social system, are supporting all of us better.

As Dr. Rankin tells us, in some States the State board of health and the county boards of supervisors are cooperating, and they are cooperating, not in saying together, "It is a good thing," but in putting up the absolute essential to all public-health progress—money. The county is putting up some and the State is putting up some, and they are working together. We are having cooperation to some extent between the National Government and the States, and in some instances the county, the State, and the National Governments are all working together on a scheme of rural sanitation. I find that there is cooperation with what we may call an international body—the Rockefeller Foundation. I find that counties are cooperating with the Rockefeller Foundation in work on rural sanitation. I find that some State boards of health have secured from their appropriation committees in their legislatures appropriations for

work in rural sanitation in cooperation with the Rockefeller Foundation. But I do not know yet of a single State board of health—and, gentlemen, I wish this to be given your serious consideration—I have not yet heard of a State board of health which has asked its legislature to appropriate any sum of money to cooperate with the National Government in attacking this great problem of rural sanitation.

The Public Health Service is doing a little work in rural sanitation. We succeeded in obtaining the sum of $25,000 for "special studies of and demonstration work in rural sanitation" during the three months ending July 1, 1916. If there were 8 or 10 States in each of which the State board of health had available the sum of $2,000 or $3,000 to cooperate with the National Government in this work, we could do at least twice as much as we can do now. And the more we do as a national health service and the more you do as State boards of health the sooner we can expect to succeed in getting that which is absolutely essential to sanitary progress and which was emphasized so well by Dr. Tuttle—we will succeed in getting the individual citizen to see that the National and State Governments are doing something for the protection of his health and that of his family. Until we do that we are going to have serious difficulty in getting reasonably adequate appropriations.

The recent work on rural sanitation done by the Public Health Service in cooperation with State boards of health and with county boards of health has yielded highly encouraging results. We have completed the survey in nine different counties, and we are now engaged in work in four other counties in different States. In every one of those counties marked sanitary improvements were effected by the house-to-house survey. In the counties of which we have fairly complete records for previous years typhoid fever was reduced by over 75 per cent. Considering the amount of money expended for the purpose, the results in these counties, we think, demonstrate the feasibility of rapid progress in rural sanitation. We should work together to extend the scope of such demonstrations.

Some agreement among State boards of health as to methods to be advocated is highly important. At the present time some State boards of health are advocating one method and other boards are advocating a radically different method for correcting the same insanitary condition. If one force of health officers goes into a community and advocates one scheme and another force of health officers in a neighboring community advocates another scheme, the people are going to decide, and decide wisely, that we do not know very well what we are talking about; and with such marked difference of opinion in evidence I believe some of us do not know what we are talking about.

I think it is high time for us to make an earnest endeavor to reach an agreement about standards for carrying out the measures which are needed for fixing an insanitary well and for fixing an insanitary privy. And I make the motion, Mr. Chairman, that a standing committee on rural sanitation be appointed from this body to take up the important phases of this subject and to report from year to year on progress and on methods for improving insanitary conditions. I suggest also that such a committee might consider to advantage a scheme for better cooperation between the State boards of health and the Public Health Service for real work on rural sanitation.

(The motion was seconded.)

Dr. GOLDBERGER. Mr. Chairman, I have been very much interested in the discussion of rural sanitation, and it struck me in listening to this discussion that it might be more helpful if we could have a definition of what rural sanitation is and what it comprises. I was especially impressed by the motion of Dr. Lumsden that we have a committee to look after problems of rural sanitation.

Now, we already have several committees, one of which is, I think, a pellagra committee. That very properly comes within the scope of rural sanitation. I do not want to contribute anything at all, except possibly to clear up a little irregularity in thinking. Let us define what we are talking about, and then perhaps we can take measures suited to carry out our objects.

Therefore, I should like to offer an amendment to Dr. Lumsden's motion to make it read "a committee whose duty it shall be to determine the limitations, the scope, and standard methods of excreta disposal in rural communities."

Dr. WOODWARD. Mr. Chairman, I move that the whole matter be referred to the committee on resolutions.

(The motion was seconded and carried.)

Dr. HAYNE. Mr. Chairman, when the discussion started out I thought I had a beautiful chance to come back at Dr. Rankin, but Dr. Trask came back at him so well that I feel that he has stolen my thunder entirely.

I do not believe in a democratic form of government. I do not believe the unintelligent individual that makes up our State or our county or our township government should decide upon the methods of sanitation in that community or town or State. Therefore, if we carry it to its logical conclusion, if we do not believe in the individual governing, if we do not believe in the township government, if we do not believe in the county government or the State government, then it brings it back to the fact that we do believe—and I do believe—in Federal Government.

Now, that sounds odd coming from South Carolina. But the difference between the fool and the wise man is that the fool and the

wise man may both make a mistake, but the wise man does no
it. Therefore, having been up against the problem in my S
individual self-government, I am compelled to believe that th
of government is not the best kind of government for the best
of that State.

Along the line of Dr. Hurty's address, I, too, believe in the
vation of the life of a man like Robert Louis Stevenson. A
physically weak, although possibly not able to propagate a
fully physical specimen, yet that man might hand down that
that burned in his brain and make this world a better place to
When we are talking about sanitation we are talking about
for individuals, for human beings, and not for hogs. It may
well to have a large boar, a physically perfect boar, but is th
going to make an intelligent razorback hog that can make hi
in North Carolina? That well-bred, that fat hog, with all hi
tors behind him making toward a fat hog, is not going to be
that will survive when stress of circumstance comes upon h
is the same way with the human being. You can pick out
man who has never worshipped at the shrine of Bacchus or V
Vulcan; you may pick out a woman who has never felt the s
passion, and they may bring a physically perfect child i
world; but will that child have any better mentality than th
of the ordinary man of the world. The clam may live a long
scientists do not tell us how long the clam will live—but wh
to be a clam? And I believe firmly—my doctrine is stric
curean—that we should enjoy the pleasures that God has put
world for us to enjoy.

Dr. RANKIN. I recognize that this principle of the rights
local government, on which the discussion has hinged, is the
mental principle involved in this question of rural health wo

Just a word in regard to what Dr. Trask has said. He sta
the principle of government and analyzes the whole thin
above down. Well, you can start in the reverse direction and
tize from below up, and you get a form of monarchical gove
I do not believe there is any such thing as an absolute de
or an absolute monarchy. But I do think, gentlemen (and
one of the important things to be considered by meetings
kind, and will be considered in a day or so by the confe
secretaries of state and provincial boards of health), that th
problems that are interstate, that are predominantly Feder
believe that there are other health problems which are p
nantly intrastate; and I do believe that there are other healt
lems, just as there are educational problems, just as there a
lems of law and order, and problems of all other phases of

ment, that are predominantly local. I think some of the health problems are predominantly local. But there is a proper division of government into Federal, State, and county, and I think there is a place for the exercise of the individual responsibility of each one of these governments in the field of sanitation.

STANDARD METHODS OF COLLECTING PUBLIC-HEALTH INFORMATION.

The ACTING CHAIRMAN. We will next take up the subject of standard methods of collecting public-health information. The question arises whether the adoption of uniform methods of accounting by the local, State, and Federal Governments is feasible, as we certainly think it is desirable. We have felt that it would be an advantage to be able to get statistics and public-health data from one State that would be comparable with those of another, and especially financial data. I will ask Dr. McLaughlin to open the discussion of this subject.

Dr. A. J. MCLAUGHLIN. Mr. Chairman and gentlemen, the lack of standard methods and of uniformity in public-health information goes into every activity that we exercise as health officers. There is a lack of uniformity in everything. I am very glad there is a tendency to limit this discussion to the financial side, and certainly there is great need of some uniformity in methods of expressing the financial well-being or otherwise of our health departments.

In the first place, to get some uniformity for purposes of comparison in the amount of money spent, and how it is spent, between the States, it would be necessary to have some uniformity of organization; and while it would not be possible, nor is it desirable to have complete uniformity, there are certain fundamental problems of organization that will come.

First, the division of the department's activity into divisions. What divisions should we have? Some departments have divisions which are not heard of in other States. It is pretty difficult to get a comparable organization. But we can agree on certain fundamentals. Of course we must have an administrative division. Possibly we can all agree that there should be a division of communicable diseases. I think we can all agree that there should be a division of sanitary engineering. And then we begin to get into trouble. For instance, some States have a division of foods and drugs, and in other States the food and drugs are handled by some other division of the State government. Some States have an industrial hygiene division or hope to have in the health department, and in other States this is handled by a separate branch of the State government. So to get organization that is comparable is a difficult mat-

ter. But that does not mean that we should not attempt organization somewhere on the same plane.

The idea of having the organization comparable, of co ried farther by having our appropriations made under the same headings, so that we can get a comparison b States as to how the money is spent, and this is also a v matter. In Massachusetts it has been the custom to ma or 18 different appropriations under specific names, bu simplified that somewhat. Last year I attempted to get priations made under four heads, and I failed. The at eral decided it could not legally be done, because it neve done in Massachusetts; and anything that never has be Massachusetts has a mighty poor chance of ever being do

So the best we could do was to make a compromise. the appropriations into about 14 heads, but we had the such a way that they could be grouped into six very e instance, under general administration—they would not g under that name, but they gave the salary of the co $4,000 for the annual report, and then gave me $18,000 f eral administrative expenses, making a total of $29,000. tary engineering appropriation is one lump sum of $5 food and drugs is in three heads, but it is grouped so t use it as one appropriation of $32,000. I got $14,300 for of hygiene, a new appropriation which in our departmen the subdivisions of child hygiene, industrial hygiene, and struction.

The communicable diseases division has four appro one for the director's salary, one for an epidemiologist, the district health officers, and $5,700 for the diagnostic but, of course, we can put it together and consider it as priation for communicable diseases. For the biological lab that is, the manufacture and distribution of antitoxin an institution of the Wassermann test, and the examination and rabies work of the Bureau of Animal Industry—we of $29,000.

So in our State we have appropriations that I think ca pared with those of other States in a fairly definite way. if you read the report of the expenditures of the State chusetts you will see that there is $600,000 charged up health, and when you analyze it you find that most of paid as reimbursement to farmers for cattle that were s in the foot-and-mouth epidemic. If you dig it out you can was spent by the health department, but it is a tedious pr can tell you in the department, because we know what we

Now, carried a little further, suppose we had comparable appropriations in the different States; then have we comparable activities? For instance, we have a man who is paid in the communicable disease division as a district health officer; but he is giving part of his time in the division of hygiene as instructor, giving lectures, etc. We are trying to get at this thing. We have a time sheet which shows just how much time each district health officer gives to the various activities of the department—so much to work on local boards, so much to lecturing for the hygiene division, so much travel, so much under communicable diseases.

In regard to how the estimate should be made, I believe in a segregated budget, but I do not want to see it enacted into law in that form. We make our estimate by items, just as in a budget. It goes to the auditor in that way, and he says: "This is a gentlemen's agreement, and if you make it in that way we will put it in the lump sum; but we want to be shown that your estimates are not away overshooting the mark." That works out very nicely. Our estimates are published, the statements of the expenses of the year before, and the pay roll added, with the increases frankly stated. Then the auditor makes recommendation to the ways and means committee, and the money is voted in a lump sum, not by items. I think it is a pretty good system.

I also believe appropriations should be specific, and that amounts appropriated for a certain purpose should not be expended for anything else. Formerly, in Massachusetts, there was a general appropriation of $42,000 or $43,000, and all sorts of expenses were being paid out of that general appropriation. I cut the general appropriation to a salary roll of the administrative officers and the expenses of the administrative officers in running the department in general. I make each division pay for its own printing; each division must pay its own incidental expenses. I found in the general fund when I went there $5,000 for the Wassermann laboratory, which had never been installed; $4,000 for an epidemiologist who had never been hired; and it was deemed no impropriety to turn it into the general fund. The auditor agreed. Now in the general fund we have what belongs there and nothing more.

I might go on indefinitely in this manner, because I am very much interested in matters of administration, and a comparison between the States is the most interesting thing in the world, if we can only get some common ground of comparison.

Mr. Chairman, I thank you.

Dr. SWARTS. Mr. Chairman, I would like to offer a resolution that a committee be appointed by this conference to formulate a scheme

whereby these figures can be obtained and distributed t
boards of health. We are all familiar with the questionnai
has come in daily to us, requiring the work of one clerk t
the same questions he answered the day before to some otl
board or some other organization, and it is one of the
annoyances, I think, of the department to know how to di
up. If we had a uniform system, and the questionnaire co
ferred right over to the Federal Health Department or
mittee of this conference, it would save us a great deal of tr

(The motion was seconded.)

The ACTING CHAIRMAN. It is moved and seconded that th
be a committee appointed to suggest a scheme to get compa
ports from State health officers in matters of accounting.
is no objection, this matter will be referred to the resoluti
mittee for proper drafting.

(Resolutions by Drs. Bracken and Warren, on school hyg
sickness insurance, respectively, were referred to the comm
resolutions.)

PELLAGRA.

Dr. HAYNE. Mr. Chairman, I made a minority report on
as chairman of that committee, on the advance that had b
in the last year;[1] and I think before we adjourn, if there
other members of that committee present—none were prese
time of my report—that this conference would like to h
work has been done, and also have some resolution introd
debated in regard to what we can agree upon as to the p
and cure of this disease. If you can agree on the cause o
is so much the better; but you certainly ought to have some r
as to the prevention and the cure of the disease. A great
us in the South find this disease probably the greatest fact
death rate of any disease that we have, except tubercul
diseases of children. Certainly we ought to take some
regard to the work that has been done, and I would like
from some of the other members of that committee, if any
are present.

The ACTING CHAIRMAN. I should like to ask Dr. Hayn
Goldberger whether they would feel free to offer a resolutio
time, or submit it to the members of the resolutions comm
think there will be time enough at the afternoon meeting,
members of the committee who are here will confer toge
present a resolution, or whatever action they may deem des
the chairman of the resolutions committeee. If there is

[1] See p. 27.

tion, that action will be taken. Dr. Hayne is chairman and Dr. Goldberger is present. Unfortunately, the other member of the committee is not here.

ESTABLISHMENT OF AN "AREA OF KNOWN DISEASE PREVALENCE."

The next topic we will discuss is "the establishment of an area of known disease prevalence." The question is raised whether it is practicable and desirable at the present time; and if so, what diseases should be reported and what standard required for admission. Some phases of this subject have already been discussed; but Dr. Fulton, of Maryland, is here, and I shall ask him to address us.

Dr. FULTON. Mr. Chairman, it would be very unkind at this hour to keep you here for the presentation in full of the subject that I have been studying for a couple of years, with a view to determining whether it is feasible or not to form a registration area for morbidity. I am going to say very little about it this morning, but I am going to ask each of you to take one of these summaries. One concerns the four years' experience for the registration States, and the other for American registration cities in a notification of four diseases—measles, scarlet fever, diphtheria and typhoid—the diseases which occur indifferently with respect to temperature, latitude, and questions of that sort.

You will find that during these years registration has regularly improved from year to year. At this moment cities can record their situations a little bit better than the States in which they are situated. There are exceptions; there are States which are better able to do this than cities.

I have been asked whether these figures that are found at the end of the column with respect to both cities and States represent the true fatality. That raises the other question as to what is the test of the completeness of registration; and I think we will have to agree that that is the only ratio that we can use as the test of the proportionate amount of sickness, as compared with deaths; whether, for instance, 1.74 is proper for measles, 3.79 for scarlet fever, 9.90 for diphtheria, 16.70 for typhoid fever, and 5.5 for all of those four diseases combined. The answer would be "No; all of those figures are too high." It is necessary, however, to make liberal terms if we are going to start registration of all sorts; and do not forget that when we get to the registration of morbidity we are going to realize, as we do not now, that there are just as many failures in the registration of sickness as there are in the tabulation of deaths. About those we are not now informed, but we shall be informed when we really go systematically into the study of current morbidity.

Morbidity and mortality of measles, scarlet fever, diphtheria, and typhoid in registration States, with fatality rates, 1912, 1913, 1914, 1915.

	1912			1913			1914			1915			Total.		
	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.
Measles	161,725	3,214	1.99	198,676	3,618	1.71	127,537	2,169	1.69	138,648	1,900	1.36	626,586	10,901	1.74
Scarlet fever	63,725	2,930	4.51	65,922	2,983	4.53	63,737	2,312	3.63	64,724	1,579	2.44	258,108	9,804	3.79
Diphtheria	68,714	7,755	11.28	72,443	6,876	9.49	68,872	7,551	10.96	75,837	5,985	7.89	285,866	28,167	9.90
Typhoid fever	32,797	6,606	20.14	40,455	6,548	16.18	34,004	5,663	16.65	31,649	4,598	14.53	138,905	23,415	16.70
Total	326,961	20,505	6.27	377,496	20,025	5.30	294,150	17,695	6.01	310,858	14,062	4.52	1,309,465	72,287	5.50

Prevalence of measles, scarlatina, diphtheria, and typhoid in certain American cities, with fatality rates, 1912, 1913, 1914, 1915.

	1912			1913			1914			1915			Total.		
	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.	Cases.	Deaths.	Fatality.
Measles	91,643	1,507	1.64	144,910	2,333	1.61	86,416	1,344	1.55	127,600	1,669	1.30	450,569	6,853	1.52
Scarlet fever	40,309	1,888	4.68	45,841	2,547	5.55	43,604	1,857	4.26	33,855	920	2.72	163,609	7,212	4.40
Diphtheria	44,761	4,081	9.11	54,454	5,055	9.26	59,494	5,086	8.54	54,755	4,424	8.08	213,464	18,646	8.73
Typhoid fever	14,013	2,073	14.78	15,535	2,436	15.68	14,031	2,323	16.55	13,329	1,937	14.53	56,908	8,769	15.40
Total	190,726	9,549	5.00	260,740	12,371	4.74	203,545	10,610	5.21	229,539	8,950	3.89	884,550	41,480	4.69

There are great differences between cities and between States. At this moment the best registration State in the United States is Utah. That is a surprising thing. We have known it for two or three years. One of the youngest States, a State just in the registration area for deaths for a short time, it is the best registration State for sickness on the whole, although not with respect to these four diseases. The District of Columbia, which is counted as a State in these registration divisions, is really an urban population, yet it sets us a first-rate standard. The most consistent performer in all of our federation of States is the District of Columbia. And similarly comparing cities, the District of Columbia is perhaps the most consistent and safest criterion that we could adopt at this time. But you could not establish a registration area on such criteria as the District of Columbia would furnish. The District of Columbia runs a mortality for measles, straight along, well under 1 per cent. Now, if we put up thirty-six one-hundredths of 1 per cent as a criterion, there is no State, no city, that would be at all eligible for the registration area.

You find the same thing with respect to scarlet fever, which is a more variable disease than measles is with respect to its fatality. More irregularities occur with respect to scarlet fever than with respect to any of the other diseases. Three and seventy-nine hundredths is a very liberal criterion. Any State which is registering scarlet fever so well as that has still a good deal to learn about the registration of scarlet fever, but that is a low standard which practically all of the States registering deaths can reach.

Now, with respect to diphtheria. The fatality of diphtheria does not depend on the nature of the disease in this sense quite so much as it does on the use of antitoxin. So you find that the States vary very much with respect to the fatality of diphtheria. Practically all registering deaths well can comply with a requirement of 9.9.

With respect to typhoid fever, for the States in general, the 16.7 is a very high fatality. The right fatality is certainly under 10, and Dr. Bracken thinks it may go down to 5 or 4. I believe the medical profession in his State of Minnesota would consent to a statement that there were more than 20 cases reportable for every death that occurs, and nearly all the States could get into a registration area under this very easy criterion of 16.7.

With respect to a method of scoring, I have thought it worth while to combine all of these diseases. There is one State particularly that does not register measles—the State of New Jersey. It registers other diseases very well. I presume in general it is merely a matter of practice as to what diseases really are reportable under the law. We have taken these four because, year in and year out, they are not particularly variable with respect to fatality, and they are the safest criteria. Tuberculosis has been suggested, and other sugges-

tions have been made; but obviously we will have to take monest and simplest criteria at the outset. If we started a tion area on this plan we should have to lower the standard deal, because our practice would grow in a few years in which would make our criteria look a little ridiculous. scored the various States in this way: How many would be on the measles score alone, 1.74? How many would get scarlet fever criterion alone, 3.79? How many on diphth How many on the typhoid criterion, 16.7? How many on th for the whole four, 5.5? That would be the fairest way, in opinion, to see what States would form that group for a beg

I would like to offer a resolution to the general effect now feasible and practicable to create a registration area bidity, and that this conference ask the Surgeon General into the feasibility of making a registration area for morbi if found feasible and practicable (of course we can only a the States' end of it, and the Surgeon General of the Publ Service must necessarily find out whether it is a practica from his viewpoint), that he formulate the registration are criteria for admissibility thereto.

Dr. BRACKEN. I would like to ask, Mr. Chairman, if Fulton's idea that a registration group should be form what is reported, or that a trial year will be taken to which States could qualify for such a grouping. The lat be a great incentive for States which are not now in p qualify, and it would stimulate reporting the morbidity

There is one point worth noting if such a registratio created, viz, that a reduction in fatality would not be ev an improvement in conditions, and that an increase in would not be evidence of an increase in disease.

I hope we may get down to a working basis on morbidi for the next year.

Dr. FULTON. I might say that this matter began to be c two years ago, and it was up last year and was discuss fully, and I am inclined to think that it would be a perfec basis, if the Public Health Bureau finds no difficulty on to make a registration area for sickness this year, on thes and it will be a very much larger registration area fo than we had for deaths a few years ago.

So I take it it will be an experimental year in any c would like the experimental year to occur this year, if with the approval of the Surgeon General.

The ACTING CHAIRMAN. Are there any other remark subject? If there is no objection, Dr. Fulton's resolutio referred to the resolutions committee.

Dr. RANKIN. Mr. Chairman, I should like to call the attention of the members to the conference of secretaries of state and provincial boards of health and invite them to attend this conference, which begins at 10 o'clock tomorrow morning at the New Willard Hotel.

The ACTING CHAIRMAN. If there are no further matters of business to come to the attention of the conference just at this time, we will recess to meet at the Hygienic Laboratory promptly at 2 o'clock, and the final session of the conference will be held in the library of the laboratory immediately after the demonstrations.

Afternoon Session, May 15, 1916.

LABORATORY ACTIVITIES.

At 2 o'clock p. m. the delegates met at the Hygienic Laboratory of the United States Public Health Service, at Twenty-fifth and E Streets, Washington, D. C., for a survey of the operations of the laboratory.

REPORT OF COMMITTEE ON RESOLUTIONS.

(The conference reassembled at 4:20 p. m. in the library of the Hygienic Laboratory.)

The ACTING CHAIRMAN (Dr. KERR). Is the resolutions committee ready to report?

Dr. SAWYER. Mr. Chairman, these resolutions have been handed in and passed on by the committee, and I now lay them before you.

HEALTH INSURANCE.

Whereas, in the opinion of the conference, it will be possible through health insurance, operated under governmental systems, not only to improve the economic status, efficiency, and health of individuals through better treatment of the sick, but also to make disease prevention by communities, States, and the Nation vastly more efficient: Therefore, be it

Resolved, That the members of this conference urge upon those who are planning legislation on this subject to provide for effective and close cooperation between the officials in charge of the administration of health insurance and the local, State, and National public health officials; and be it further

Resolved, That we indorse the principles of health insurance operated under governmental systems.

(Resolution adopted.)

INTRASTATE QUARANTINE REGULATIONS.

Resolved, That the conference recommends the appointment of a committee on intrastate quarantine regulations to consider the regulations of the various States and to report to the conference at the next annual meeting on methods of handling communicable diseases.

(Adoption moved by Dr. Tuttle and seconded.)

The ACTING CHAIRMAN. In putting the motion I would
of course it is understood that this conference, so far as th
Health Service is concerned, would not wish to dictate wha
be done within a State, and it is only for the purpose of harm
the regulations that have already been issued by the Secr
the Treasury with those of the several States that the quest
brought before the conference.

(The resolution was adopted.)

ESTABLISHMENT OF AN "AREA OF KNOWN DISEASE PREVALE

Resolved, That this conference believes it is now feasible to cres
istration area of known disease prevalence, and recommends that the
General inquire into its practicability from the standpoint of the Publ
Service and determine the standard for admission of States and citie

(Resolution adopted.)

STANDARD METHODS OF COLLECTING PUBLIC HEALTH INFORM

Dr. SAWYER:

Resolved, That the conference recommends the appointment of a
to formulate standard methods of accounting for State boards of he

(Adoption moved by Dr. Bracken and seconded.)

Dr. KELLEY. Mr. Chairman, I move that we amend that
"method for accountancy." I think "method of account
State boards of health" is beyond some people.

Dr. WOODWARD. Mr. Chairman, do we understand that
cludes accounting for money expenditures and also of res
tained so that the two can be correlated?

Dr. RUCKER. That was the idea.

The ACTING CHAIRMAN. If I may state my own views, I sh
to see it include both.

Dr. SAWYER. Mr. Chairman, would this change in the
improve it:

Resolved, That the conference recommends the appointment of a
to formulate standard methods of accounting for disbursements a
for State boards of health.

Dr. FULTON. It seems to me that the best verbiage we c
would probably be that in the question itself, as printed on
gram this morning, for that was clear and was inclusive.

The ACTING CHAIRMAN. It is understood that this committ
be a standing committee, and perhaps its scope could be l
that account.

Dr. WOODWARD. The term "cost accounting" would probal
it. That is the term that would be used commercially, I thi

Dr. SAWYER. If we said "cost accounting and determination of results," would that be more clear?

Dr. WOODWARD. With respect to the large number of the operations of any health authority, although you may not be able to determine what the results are, yet you can estimate the cost of the undertaking.

Mr. HANSEN. Mr. Chairman, I would like to suggest that an amendment be adopted to the effect that this committee is to consider the organization, accounting, and budget making of State health departments.

(The motion was seconded.)

The ACTING CHAIRMAN. In effect, the resolution as amended is as follows:

Resolved, That the conference recommends the appointment of a committee to formulate standard methods of recording public health data, with particular reference to cost accounting by State health agencies.

(The amendment and the resolution as amended were adopted.)

RURAL SANITATION.

Resolved, That the conference recommends the appointment of a committee on rural sanitation to report at the next annual conference on methods and standards for the improvement of the health of rural communities.

(The resolution was adopted.)

SCHOOL HYGIENE.

Dr. SAWYER. The next resolution:

Resolved, That it is the sense of this conference that the sanitation of schools and the protection of the health of school children should devolve on health authorities; be it further

Resolved, That the extent of the teaching of hygiene in schools and the methods to be adopted should be determined by educational authorities; and be it

Resolved, That the health and educational authorities should cooperate in these matters.

(Adoption moved by Dr. Tuttle and seconded.)

Dr. WOODWARD. It seems to me that we should hardly so readily surrender to the educational authorities the right to decide what will be taught concerning matters of health. I think that the least we could do with respect to that would be to say nothing. I believe that the teaching of health ought to be at least to the satisfaction of the health authorities. They ought to have the last say as to how it should be taught and what should be taught, if we are going to get harmony. I dislike very much to disturb the report of the committee, but otherwise I should be inclined to move that

so much of the report as relates to the teaching of health be omitted; that we at least remain silent on that subject.

Dr. BRACKEN. Mr. Chairman, as I helped to frame the resolution, I accept the suggestion of Dr. Woodward. I think he is quite right in his position.

Dr. SAWYER. Would the first clause alone be sufficient?

Dr. WOODWARD. I think you would have to provide that the health and educational authorities should cooperate in the matter of inspection of schools. It is simply impossible to establish an inspection of schools without the cooperation of the school authorities. You have got to depend on the teachers and school principals for certain work.

(Resolution as amended read:

Resolved, That it is the sense of this conference that the sanitation of schools and the protection of the health of school children should devolve on health authorities, and that to these ends they should have the cooperation of the proper educational authorities.)

(Resolution adopted.)

INCREASING EFFICIENCY OF CONFERENCES.

Dr. SAWYER:

Resolved, That it is the sense of the conference that in order that its deliberations in future may take wider counsel in State matters, that State departments or State boards of health might well hereafter include in the delegation from their States such local health authorities as may be deemed advisable, it being understood that in matters requiring a vote under the law each State is entitled to only one vote.

(Adoption moved by Dr. Rucker and seconded.)

Dr. RANKIN. Mr. Chairman, may I ask if that resolution has been approved by the resolutions committee?

Dr. SAWYER. It was approved by those of us who were here together just before the meeting was called. Dr. Rucker and I went over it.

Dr. LUMSDEN. Mr. Chairman, is it stated who shall deem it advisable or inadvisable as to what local health officer shall be invited?

Dr. SAWYER. It is not clearly stated.

Dr. LUMSDEN. Is that left with the State health officer or the executive officer of the State board of health?

Dr. SAWYER. That was our supposition.

Dr. JEPSON. The great difficulty about that is in the payment of the bills. In the case of local health authorities, who is going to do it?

Dr. RUCKER. Mr. Chairman, that portion of the resolutions committee which handled this matter has considered the subject in this wise: This body is constantly discussing matters which are of intense

value to municipalities and to county health organizations. At the present time such officers are not invited to be present at these conferences, nor do they have a legal right to attend. These men can throw light on these problems in a way that we can not. They look at the thing in a very different way from what the States do; they look at it in a different way from what the Federal Government does; and it would seem as though, if it were just understood that they would not be unwelcome at these conferences, it might be that the conference could avail itself of information secured in this way which it would not otherwise have. This resolution does not bind anybody to issue the invitations for them to come, or anybody to pay the expenses. It merely says, in effect, if a State wants to include in its delegation a municipal health officer or a county health officer, or a number of these gentlemen, that these men will be welcome when they come to the conference. It is merely an idea to get more minds and more information from other angles into the conference.

Dr. WOODWARD. Mr. Chairman, I would move the following substitute for this resolution:

Resolved, That the conference recommends the appointment of a committee to report at the next annual meeting on possible methods of increasing the efficiency and extending the influence of future conferences.

(Motion seconded and substitute adopted.)

PELLAGRA.

Dr. SAWYER:

Resolved, That this conference is of the opinion that the preponderance of evidence indicates that pellagra is a dietary disease, and that the only method which furnishes a practical means for treatment and prevention of the disease is by a properly balanced diet of fresh animal food and legumes.

(Adoption moved by Dr. Tuttle and seconded.)

Dr. FULTON. Mr. Chairman, I have very grave doubt about the propriety of passing a resolution of that sort at all. I conceive we are here to consider administrative matters and questions of that sort, but I doubt very seriously the competence of this committee to express an opinion at all on that resolution, one way or the other. What I say for myself I take the liberty of saying for at least half the people present—that they are absolutely incompetent to vote on a question of that sort.

Dr. LUMSDEN. Mr. Chairman, I think this is one of the most potent items which has been reached in the program of this conference. I think for a resolution on this subject to be tabled by this conference it would have a very serious effect. If we do believe at this time that the best we can do for the treatment and for the prevention of pellagra is to feed the people and feed them a certain kind

of diet, the tabling of this resolution by this conference would be a grave mistake. Such action would set back very seriously the good results of the work done and being done. If this resolution is to be voted on, I suggest, if it is in order at this conference, that we have either a roll call or a rising vote on it. If the health officers of this country are ready at this time to express an opinion about the best method for the prevention and for the cure of pellagra, I think that proper action on this resolution now will do much to lift from our people a great burden of suffering. I think a resolution of this character coming from this conference at this time and being published, so that the people of the country would know that the health officers of the different States gathered here in this conference agreed that this is the best that can be done for the prevention and cure of pellagra, would have a very wholesome effect, and would start a lot of people to eating meat, eggs, milk, and beans who otherwise could not be expected to start eating them for some years to come.

Dr. LEATHERS. Mr. Chairman, I simply want to emphasize the remarks of Dr. Lumsden. In many of the Southern States this problem of pellagra is a very serious one. It stands next to tuberculosis, perhaps, in importance, and increases the death rate enormously. The most frequent question asked by the people of health officials is, What is the cause of pellagra? Now, if we are put into the attitude of feeling that in any action by this conference we had better be very cautious and qualify our statement, our action would have very little effect with these people. They are not in a position to analyze a statement of that kind, and if they see that you doubt in the least what you are trying to accomplish, they will have an even greater doubt in regard to the matter.

I am not very much informed on all of the work that has been done on pellagra, but it is my candid opinion that the resolution states the truth; and we ought not to be afraid of the truth. So I am heartily in favor of the resolution. I think it would be a great mistake not to adopt it.

Dr. GOLDBERGER. Mr. Chairman, I should like to say a word or two for the information of the conference. I think the majority of the gentlemen here are from States where pellagra is hardly a problem worth serious consideration, and in all probability have paid little or no attention to the matter and think it not of sufficient importance to take up at this conference. To a very large part of the country, however, it is a matter of the most profound and vital importance, affecting as it does the health, life, and economic status of, roughly, all of the Southern States. I may say, too, for the information of the gentlemen not from that section, that as a matter of practical fact quite a number of the Southern States are actually working along these lines; and to pass these resolutions would be

simply giving those men who are already, on their own initiative, doing this thing the moral support of the conference. For example, I believe North Carolina has taken or is about to take official action in the control and prevention of pellagra along dietary lines. I know that Dr. Hayne has stated—I am sorry he is not here to state it for himself—that he appealed to his last legislature for an appropriation to take up the fight along these lines. I know that the State of Florida is officially working along these lines. I know it also to be a fact that the State of Louisiana has, at least tentatively, taken this up and is trying to do what it can to fight the disease on dietary lines. I know that officially Arkansas has taken similar action. I understand that Tennessee, Kentucky, and Virginia are in the same position. Therefore, as a matter of practical fact, what these resolutions state would be simply supporting these men who are pioneers in taking this fight up against what may be the majority opinion of the medical profession.

These are the reasons why, in my opinion, it is of such great practical importance for this conference to pass this or substantially this resolution.

Dr. SAWYER. There are two very distinct parts to this resolution. One is that those of us who have read the reports and are judging on the basis of merely passing on the evidence believe that the preponderance of the evidence indicates or suggests that the disease is a dietary disease. That is one part which we can consider separately if necessary. The other part is that we believe that dietary treatment is the only method which is promising in the present state of our knowledge. I think it might clear up the matter a great deal if we found out from Dr. Fulton whether he is objecting to the whole resolution, to both parts, or only to one part; and if so, which part it is which is objected to.

Dr. FULTON. Mr. Chairman, I would like to make my position perfectly clear. I think it is very unfortunate for a conference of this sort to pass on such matters at all. It seems to me that the fact that there is an argument for a resolution is sufficient to take away all the ground on which it was offered here. There are a certain number of people here whose opinions are of value on a question of that sort. Now, it is thought that those opinions can be strengthened by getting the votes of a lot of people who know nothing whatever about it. If that question comes to a vote, there is only one of two things that can be done; a man can vote aye or he can vote no. I intend, if it comes to a vote, to vote no. My vote no will simply signify that I know nothing whatever about it. But I do think that the resolutions ought not to be passed. I think it would be a very bad precedent, no matter what the merits of the question at issue are. We will be undertaking to add to a certain body of scientific opinion. If all

who are as ignorant as I am on the subject should vote no, the resolution would still pass. But in what sense would the opinion be strengthened? In none whatever. On the contrary, the very fact that there seems to be a great desire to have a thing of that sort passed would seem to me to indicate some inherent weakness in the argument. Scientific questions are never settled by counting ayes and noes. If Dr. Goldberger is right, as I hope he is, his opinion on that is worth a thousand of mine, and a carload of my votes would have no value whatever. It is a perfectly fictitious way of supporting a scientific assertion. That is the reason why I expect to vote no, and I should be very sorry if the conference should establish the precedent of taking votes on questions of that sort.

Mr. HANSEN. Mr. Chairman, as an engineer I am somewhat in the same position as the previous speaker, but I think the matter can be settled in this way: We are all sanitarians, and we are all competent to judge of the great value of the work of Dr. Goldberger and his associates, and I think therefore we are competent to say specifically that we know about his work, that we approve of it, and that we believe that proper diet will both prevent and cure the disease, and therefore we would recommend that dieting be used as a means of combating the disease.

Dr. LUMSDEN. My understanding of this resolution is that it is not a question of the scientific determination of the cause of pellagra, but rather a question of propaganda. Are State health officers in a position now to advocate any line for the prevention or for the cure of pellagra? It is to determine whether this conference is ready to go on record as advocating a definite line for the prevention and cure of pellagra.

The ACTING CHAIRMAN. Do you regard the resolution as well worded to convey the meaning that you have given it?

Dr. LUMSDEN. It impressed me as covering the ground. If anybody asked me what to do with persons suffering from pellagra, I would say, "Feed them"; and I think most of us feel that way. So why not go on record?

Dr. BRACKEN. Mr. Chairman, I do not know any more about this than Dr. Fulton does. As I look at it, it seems to me that the resolution represents rather a vote of confidence in the work that has been done so far, and as an ignoramus on the general subject I am ready to vote yes on the resolution.

The ACTING CHAIRMAN. If I may say a word, I should not want, as an officer of the service, to see a resolution passed which would simply be a vote of confidence. We propose to carry on such investigations as we undertake so that people will have confidence in them; and until we do, they do not need to accept them. The simple question appears to me to be whether, as administrative officers, we are

at this time in a position to advise individuals and communities of a method which has been successful, and which for the time being at least should be adopted, both for the cure and for the prevention of pellagra.

Dr. BRACKEN. I agree with you, Mr. Chairman, as to a mere vote of confidence, but that is not worded as a vote of confidence. It is in a sense a vote of confidence, when it comes to a man like myself voting yes.

Dr. SEEMANN. Mr. Chairman, I do not believe that this question is being looked at in the proper light. We are not here to decide whether bacillus Welchii is the cause, or whether Harris's monkey had pellagra, or whether anything else happened. We are here to take advantage of definite results which have taken place in the Southern States. In the Bogalusa Hospital trials were made of this dietary treatment of pellagra, and the results have been most excellent—above our expectations. Likewise in many other parts of Louisiana I have personally observed the most excellent results. Now, we are not concerned, as I remarked, about what is the cause of pellagra from the strictly scientific standpoint; but we do know, as sanitarians and health officers, that this dietary treatment gives results both for prevention and for cure, and it is wrong for us as health officers not to stand boldly and proclaim this fact, which is called a theory, to the public who trust to us for advice, in order that they may be protected from the hordes of quacks who prey on pellagra victims. Why, you gentlemen have no conception of the amount of charlatanism that is going on in connection with pellagra, and if you refuse to adopt this resolution you virtually, by your negative vote, break down the very foundation upon which our work is founded, and you leave us in the South in a most humiliating position of having to tell our people down there that we have been telling them to do something that the conference of health officers found inadvisable; because no other conception can be taken of a vote to table or a negative vote on this proposition. It is before us now. It might have been more fortunate had it not been presented, but we have it here, and it is a question that we must be men enough to decide. I believe that anybody who knows anything about the subject can only decide it one way.

Dr. WOODWARD. Mr. Chairman, I sympathize somewhat with Dr. Fulton in his point of view with respect to part of this resolution, although I think he has hardly given it the attention it deserves.

The first clause pretty nearly damns the case by its weakness, that is, "that the preponderance of evidence indicates that pellagra is a dietary disease." I do not think we can question that very seriously. We will have to agree that the preponderance of the evidence at present does indicate that. But we are not even putting our-

selves on record that pellagra is a dietary disease. The clause is so weak that it is liable to hurt the cause. Dr. Fulton is right to this extent, that, so far as the public is concerned and so far as the medical profession is concerned, this clause might indicate that we, really not a scientific body, were undertaking to determine a scientific fact.

Everyone will have to admit, no matter what he may believe with respect to the causation of pellagra—and I will be perfectly frank and say I have not made up my mind as to the cause—that it has been demonstrated that by the use of improper foods pellagra can be caused, and that by the use of proper foods it can be cured.

Dr. SEEMANN. Put that into the resolution.

Dr. WOODWARD. So far as causation is concerned, however, we have a similar situation in respect to quinine in malarial fever. It is not the absence of quinine that causes malarial fever, although if it be withheld in a malarial region malarial infection is apt to follow and the administration of quinine will cure it. So the fact that an improper diet precedes the occurrence of pellagra, and the administration of a proper diet cures it, does not necessarily mean that the diet had anything to do with the causation. I think, though, we could all go on record in a resolution, as an administrative body, that the only known method which at present furnishes any hope for the prevention of pellagra, or for the cure of pellagra, is a properly balanced diet—including, we will say, fresh meat and legumes. We could indorse that, and I think it would accomplish the purpose sought.

Dr. STILES. Mr. Chairman, it seems to me that in the original resolution there is an unfortunate expression used—that the diet is the only method to cure pellagra, or words to that effect. In the discussion another point has been brought out, that in our present knowledge that is the only method. It seems to me that qualification should appear in the resolution.

Dr. GOLDBERGER. Mr. Chairman, if I may be permitted to remark once more, I think, perhaps, Dr. Fulton is absolutely right when he takes the position that no body such as this (or any other body, for that matter) can by any sort of resolution or series of resolutions decide a scientific question. Scientific questions are never settled that way, although they may appear to be. Mr. Hansen has stated the point quite correctly. We may not all of us know whether John Smith murdered Jane Smith, but we are competent, if we are endowed with average intelligence, to pass on the competency of evidence adduced. Now, in this case, too, a certain matter is brought forward for the opinion of the conference, and the conference is presumed to be able to pass on the sufficiency of the evidence that has been adduced. The resolution simply calls for an expression of

opinion as to certain facts relating to the treatment and prevention of pellagra. I think, perhaps, it would be a better resolution if it were put in somewhat the way Dr. Woodward has suggested: That it has been proven that pellagra may be produced by an improper diet, and that pellagra may be cured or prevented by a proper diet, and therefore be it resolved that we recommend to all health officials and others concerned that appropriate action be taken with respect to the carrying out of these measures looking to the prevention and treatment of the disease.

There is just one other point I would like to touch on. The point Dr. Woodward made in connection with the matter of the cause of pellagra was this, that the fact that malaria is prevented by quinine does not prove that the absence of quinine produces malaria; and by analogy that, although proper diet prevents pellagra, that does not prove that the absence of proper diet produces pellagra.

This is an exceedingly interesting and enticing form of argument. The only difficulty with it, it seems to me, is this, that the analogy is incomplete and imperfect. This argument would be entirely valid, provided quinine were a usual, essential ingredient of a normal diet. But inasmuch as it is not, the argument falls to the ground.

Dr. WOODWARD. Unless the committee on resolutions has drafted something superior to my phraseology I would offer a resolution as a substitute, something as follows:

Whereas, in the judgment of the conference of State and Territorial health officers with the United States Public Health Service, it has been demonstrated that the absence of a proper diet may be followed by pellagra, and that the consumption of a proper diet will prevent and cure the disease; Therefore be it

Resolved, That this body recommends that as a standard and routine method for the prevention and cure of pellagra the health authorities endeavor to bring about the use of proper dietaries, including fresh meat and legumes.

Dr. FULTON. Mr. Chairman, is my objection precipitating all this effort to make a very agreeable kind of resolution? Because, if so, it is quite unnecessary. My objection is to the resolution as a whole and the policy of this conference. It is a perfectly simple matter to pass it. I do not know anybody who is going to vote against it except myself, and I do not think my vote signifies anything at all. I simply object to being counted as voting on a question on which I have no competent opinion.

Dr. BIDDLE. Mr. Chairman, without rising to my feet I suggested placing the resolution upon the table. Now I will show you how inconsistent I am. The State Board of Health of Michigan is on record as adopting this precise resolution. Pellagra was declared noncommunicable in September of last year, and we have practically gone on record in black and white to the entire State of

Michigan in almost the language that is in this resolution, so that I would be voting against my own act if I voted against the resolution and what it contains.

Dr. STILES. Mr. Chairman, I would like to offer the following substitute to the original resolution:

Whereas, it has been demonstrated that a properly balanced diet will prevent and cure pellagra; therefore, be it

Resolved, That the conference indorses the use of a properly balanced diet as the only method now known by which the disease may be combated.

(The substitute resolution offered by Dr. Stiles was seconded and adopted.)

MORBIDITY REPORTS.

Resolved, That the annual reports forwarded to the Public Health Service by State and Territorial health departments, showing the recorded prevalence of disease during the preceding calendar year and containing a statement of the number of reported cases and of registered deaths from each of the notifiable diseases, can with advantage be changed to two separate reports, as follows: (1) A report of cases of notifiable diseases, to be mailed by the several State health departments not later than February 1; and (2) a report of registered deaths from the notifiable diseases, to be mailed by the several State health departments not later than March 1.

(The resolution was adopted.)

REPRESENTATION OF STATES AND TERRITORIES AT CONFERENCES.

Whereas, effective public health work and its growth in the United States depend upon cooperation and correlation of the work of the several State health departments with each other and with the Federal Public Health Service, and whereas only 28 States and Territories and the District of Columbia are represented at this conference; therefore, be it

Resolved, That it is the feeling of the conference that the loss has been double, that the conference has been deprived of the benefits of the counsel and experience of the States and Territories not represented, and that they have been deprived of the benefits derived from the personal exchange of experience and the discussion resulting therefrom.

(The resolution was adopted.)

COMMITTEE APPOINTMENTS.

The ACTING CHAIRMAN. There were two committees provided for during this forenoon's session, and I will read the names of those committees at this time.

COMMITTEE ON RURAL SANITATION.

The committee on rural sanitation will consist of Drs. Rankin, Tuttle, Dalton, Hayne, and Lumsden.

COMMITTEE ON INTRASTATE QUARANTINE REGULATIONS.

The committee on intrastate quarantine regulations will consist of Drs. Woodward, Garrison, Sawyer, Kelley, and Rucker.

There are two or three other regular committees which have been provided for by resolution, and if agreeable to the conference the membership will be made up later and communicated by correspondence.[1]

Dr. WOODWARD. Mr. Chairman, I hope you will leave me off that committee on intrastate quarantine regulations. My intrastate quarantine regulations are delightfully simple, with an area of 60 square miles only, and I have no experience and no particular knowledge.

The ACTING CHAIRMAN. Dr. Woodward, I feel that when the committee takes up the work it will not really be as complex and relate to States and Territories, but that it will deal more with principles and harmonizing or bringing about uniformity in interstate quarantine matters. So I feel that the department would be losing by your being relieved from the committee.

Dr. JEPSON. I move, Mr. President, that the thanks of this body be tendered to the United States Public Health Service, which has shown us so many courtesies.

(The motion was seconded.)

(The question was put by Dr. Woodward, and carried unanimously by a rising vote.)

The ACTING CHAIRMAN. On behalf of the bureau and department I wish to thank the delegates and guests for their presence here; and if there is no other matter of business I will declare the conference adjourned.

(Accordingly, at 5.30 p. m. the conference adjourned.)

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[1] Membership of other committees established at this conference will be found on p. 6.

STATE AND TERRITORIAL EXECUTIVE HEALTH OFFICERS.

Alabama.—Dr. W. H. Sanders, State health officer, Montgomery, Ala.

Alaska.—Gov. J. F. A. Strong, ex-officio commissioner of health, Juneau, Alaska.

Arizona.—Dr. R. N. Looney, superintendent of public health, Prescott, Ariz.

Arkansas.—Dr. C. W. Garrison, State health officer, Little Rock, Ark.

California.—Dr. W. A. Sawyer, secretary State board of health, Sacramento, Cal.

Colorado.—Dr. S. R. McKelvey, secretary State board of health, Denver, Colo.

Connecticut.—Dr. John T. Black, secretary State board of health, Hartford, Conn.

Delaware.—Dr. A. E. Frantz, secretary State board of health, Wilmington, Del.

District of Columbia.—Dr. W. C. Woodward, health officer, Washington, D. C.

Florida.—Dr. J. Y. Porter, State health officer, Jacksonville, Fla.

Georgia.—Dr. H. F. Harris, secretary State board of health, Atlanta, Ga.

Hawaii.—Dr. J. S. B. Pratt, president board of health, Honolulu, Hawaii.

Idaho.—Dr. Ralph Falk, secretary State board of health, Boise, Idaho.

Illinois.—Dr. C. St. Clair Drake, secretary State board of health, Springfield, Ill.

Indiana.—Dr. J. N. Hurty, State commissioner of health, Indianapolis, Ind.

Iowa.—Dr. G. H. Sumner, secretary State board of health, Des Moines, Iowa.

Kansas.—Dr. S. J. Crumbine, secretary State board of health, Topeka, Kans.

Kentucky.—Dr. A. T. McCormack, secretary State board of health, Bowling Green, Ky.

Louisiana.—Dr. Oscar Dowling, president State board of health, New Orleans, La.

Maine.—Dr. A. G. Young, secretary State board of health, Augusta, Me.

Maryland.—Dr. J. S. Fulton, State health officer, Baltimore, Md.

Massachusetts.—Dr. A. J. McLaughlin, State commissioner of health, Boston, Mass.

Michigan.—Dr. J. L. Burkart, secretary State board of health, Lansing, Mich.

Minnesota.—Dr. H. M. Bracken, secretary State board of health, St. Paul, Minn.

Mississippi.—Dr. J. T. Gilleylen, secretary State board of health, Jackson, Miss.

Missouri.—Dr. J. A. B. Adcock, secretary State board of health, Jefferson City, Mo.

Montana.—Dr. W. F. Cogswell, State health officer, Helena, Mont.

Nebraska.—Dr. H. B. Cummins, secretary, board of secretaries, State board of health, Seward, Nebr.

Nevada.—Dr. S. L. Lee, secretary State board of health, Carson City, Nev.

New Hampshire.—Dr. I. A. Watson, secretary State board of health, Concord, N. H.

New Jersey.—Dr. Jacob C. Price, director State department of health, Branchville, N. J.

New Mexico.—Dr. W. E. Kaser, secretary of State board of health, Las Vegas, N. Mex.

New York.—Dr. Hermann M. Biggs, State commissioner of health, Albany, N. Y.

North Carolina.—Dr. W. S. Rankin, State health officer, Raleigh, N. C.

North Dakota.—Dr. C. J. McGurren, superintendent of public health, Devils Lake, N. Dak.

Ohio.— ——— secretary State board of health, Columbus, Ohio.

Oklahoma.—Dr. John W. Duke, State commissioner of health, Oklahoma City, Okla.

Oregon.—Dr. David N. Roberg, State health officer, Portland, Oreg.

Pennsylvania.—Dr. Samuel G. Dixon, State commissioner of health, Harrisburg, Pa.

Philippine Islands.—Dr. J. D. Long, director of public health, Manila, P. I.

Porto Rico.—Dr. William F. Lippitt, director of sanitation, San Juan, P. R.

Rhode Island.—Dr. Gardner T. Swarts, State commissioner of health, Providence, R. I.

South Carolina.—Dr. James A. Hayne, State health officer, Columbia, S. C.

South Dakota.—Dr. P. B. Jenkins, superintendent of public health, Waubay, S. Dak.

Tennessee.—Dr. R. Q. Lillard, secretary State board of health, Nashville, Tenn.

Texas.—Dr. W. B. Collins, State health officer, Austin, Tex.

Utah.—Dr. T. B. Beatty, secretary State board of health, Salt Lake City, Utah.

Vermont.—Dr. Charles F. Dalton, secretary State board of health, Burlington, Vt.

Virginia.—Dr. Ennion G. Williams, State commissioner of health, Richmond, Va.

Washington.—Dr. T. D. Tuttle, State commissioner of health, Seattle, Wash.

West Virginia.—Dr. S. L. Jepson, State commissioner of health, Charleston, W. Va.

Wisconsin.—Dr. C. A. Harper, secretary State board of health, Madison, Wis.

Wyoming.—Dr. W. A. Wyman, State health officer, Cheyenne, Wyo.

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